BIG DATA ANALYSIS SUPPORTING SMART CITY IMPLEMENTATION (PRACTICAL STUDY IN TELKOM COMPANY)

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Abstract

The Implementation and monetization of Big Data Analytics technology in the telco company have assisted top management to figure, to decide a policy and direction of the companies strategic to meet its goals agree on the vision and mission of the company. This study aims to give a brief overview the Big Data Implementation in Telkom Indonesia with creating solutions using Big Data Analysis as Social Data Analytics, Customer Analytics, Product Analytics, Sales & Marketing Analytics and Operations Analytics for later use to support the implementation a smart city. The use of Big Data Analysis by the local government in several cities in Indonesia is one of the solutions for the local governments to give a rapid response and the right solution in the midst of the increasing problems of the existing town. This study is to do to assess the Big Data Analysis supporting Smart City Implementation. This study is to do On Desk Research by gathering information from the internal and external organization.

Introduction

Smart City as a concept of managing a city, rests on the use of ICT includes the concept of sensing (detecting), understanding (understand), and acting (action) [1] to live in an area of governance, policies, people and all those involved in it are interrelated. With the Smart City concept is the right time for local governments to begin to adopt and improve innovations in the field of ICT to enhance the level of service that can be provided to the public.

In fulfilling characteristics such as Smart City, data needs to be one of the main issues. Data from various sectors of life has a very large number. It takes a Big Data technology capable of storing, analyzing, integrating, and simultaneously working in real time in order to support the performance of a city.

Challenges in Big Data include acquisition, curate, storage, search, the distribution, transfer, analysis, and data visualization. The growing trend of increasing the amount of data caused by the increase of information from large sets of interrelated, compared with other small associations with the total number of the same data. The new correlation can be founded in the analysis of data sets in order to look at business trends, determine the quality of research, preventing disease, fighting crime, and determine the condition of highway traffic in real time.

Literatur Review

A. Smart City

Smart City is about supporting **cities, districts**, or **regions** in fulfilling some of their key missions by the support of ICT with **Smart** and **Intelligent** solutions and technology such as Providing **New Services**, Optimizing **Existing Services**, Allowing **savings on key limited resources** (energy, water, space, etc) and **Enhancing the relationship between** the city and its citizens including business and tourists[2].

Figure 1. TELKOM Smart City Concept

Along with the increasing number of population and the complexities of the various aspects of community life, these matter will become a major challenge for the city government in order to create a city that is able to provide comfort for all citizens and then many cities competing to promote the concept of Smart City as a major step for the progress in the city.

B. Big Data

Big data is data that exceeds the processing capacity of conventional database systems. The data is too big, moves too fast, or doesn't fit the layout of your database architectures. To gain value from this data, we must choose an alternative to processing [3].

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Big Data is a term that describes the continuous increase of data, and technology needed to collect, store, manage, and analyze it. It is a complex phenomenon and multi-dimensional, impact on people, process, and technology [4]. From a technology perspective, Big Data includes hardware and software that integrate, organize, manage, analyze, and present data.

Another definition, Big Data is a data overflow in a speed never seen before - doubling every 18 months - as a result of access to customer data that is larger comes from public sources, exclusive, as well as new information gathered from the web community deployed in a way new. (Bughin, Chui, and Manyika, 2010).

The term "Big Data" is often used by companies to describe the huge amount of data. This does not refer to the specific amount of data but outlines a set of data that can't be stored or processed using traditional database software. Big data is often distributed over many storage devices, can be in several different locations. There are several different types of software solutions for different big data, including data storage platforms and data analysis program.

Big Data has the scale, distribution and / or considerable diversity, thus requiring the use of technical architecture and specific analytic methods to gain insights that deliver new value to the business.

Big Data is often associated with 3V characteristics, namely volume, velocity, and variety, where the definition of Big Data is not only large in terms of volume of data, but also other indicators [5].

Table 1. Big Data Characteristic (source: mcnulty, 2014)

VOLUME	VELOCITY	VARIETY
very large number of data, its can be billion lines and million columns, even more	data is growing very fast that cause the process and analysis towards Big Data must be carried out in real time	data has complex type and structure, being produced from various source with various format and structure

In a complex indicator that there are 4 additional characteristics are visualization (drawing data), veracity (ambiguity data), variability (continuity of data changes) and value (benefit for the company)[6].

Big Data is used to assist companies in the development of capabilities, performance and internal reinforcement. Big Data is able to improve the performance, and image of the company, provides improved advertising, increasing the value of the project, manage business risk. According to Brain & Company, the company advantages in the aspects of Big Data Analytics company's financial performance will be increased by twice better and in decision-making will increase five times faster, and in the execution of the decision

as desired to increase three times more successful. Through various forms of output, the implementation of Big Data in the organization will give a better value in a data-driven decision making [7].

In the Telco industry, a number of companies are offering Big Data with diverse business models.

Table 2. Global Benchmarking – Telco Industry (source: IDC, 2014)

Singtel	StarHub	Spark
Customer Analytics	Data as a Service	Platform as a Service
The Digital Life Group is utilizing the analytical ability to offer a personalized service that is more appropriate in order to create a better customer experience.	StarHub provides data analytics platform anonymously using customer data to understand customer behavior or to test new products.	As a cloud platform, Spark Telecom offers a PaaS and SaaS that enables the company to the privately hosted their own data and integrate it with public data to gain insight.

Table 3. Global Benchmarking – Non Telco Industry

Walmart	Nike	Commonwealth Bank
In 2013, Wal-Mart Labs buy Inkiru used for predictive analytics on big data. This technology is designed to retrieve data from multiple sources and help Wal-Mart in creating marketing campaigns to target consumers [8].	Nike, Inc. using big data to develop new products, organizing decision-making in real-time, and supply chain management [9].	With big data, Commonwealth Bank of Australia has a solution for new product development, marketing strategies, and portfolio segmentation [10].

Big Data market growth is supported by three interrelated elements, namely infrastructure, software and services in the implementation of Big Data to support Indonesia into a "digital economy". The third main key Big Data market included:

- Use of the infrastructure for external storage and cloud.
- The use of advanced software for discovery and decision-making tools.
- The use of service becomes an important key in the role of Big Data market because the service will be a special expertise to create fulfilling demand for consulting services and implementation of Big Data.
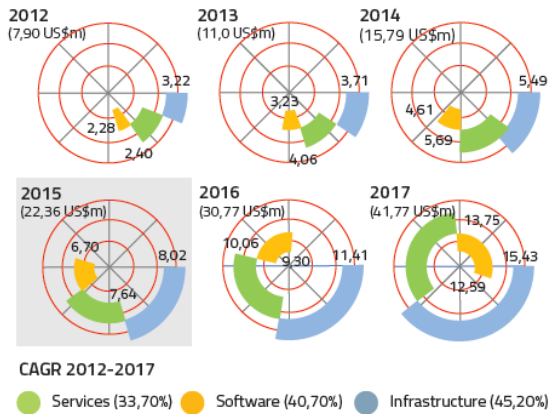
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Figure 2. Element Service, Infrastructure and Big Data Software

Figure 3. Operating Model

Of the service element, big data solution providers can further leverage their infrastructure and software elements.

Methodology

This research is a practical study on Big Data Analytics in supporting the implementation of Smart City. In conducting this practical study, the authors use On Desk Research methods.

Desk research is basically involved in collecting data from existing resources hence it is often considered a low-cost technique as compared to field research, as the main cost is involved in executive's time, telephone or internet charges and directories. However, it could also be a complete waste of time and money if the researcher does not have the proper knowledge of how the research in performed [8].

Basically, there are two types of desk research techniques namely Internal Desk Research dan External Desk Research. In conducting Internal Desk Research the authors get a lot of information from inside the organization as a normal process. While for External Desk Research, the research conducted by collecting relevant information from outside the organization in Online Desk Research.

TELKOM develop operating models as a reference process for obtaining value from Big Data. Operating this model has three basic elements, namely input, process, and output. There are three sources of data for analytical purposes, namely: Data owned by customer, Data coming from social media, Data sourced from internal company consisting of data from traffic Telkom services and external data (including data on the public internet) , as well as platform support and regulation, then the value can be obtained that are beneficial to business continuity.
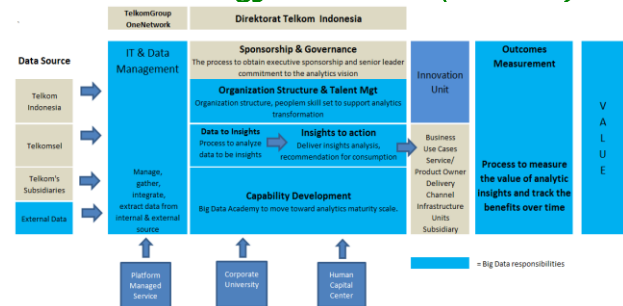
Big Data analytics requires reliable technology support, especially to handle large volumes, complex variety, and velocity fast. Here is 4A, a form of Big Data technology in the Telkom Group:

- Acquired
  Associated with efforts to obtain the data, both structured data and unstructured.
- Accessed
  The Power associated with data access. Data already collected need governance, integration, storage, and computing that could be managed for the next stage.
- Analytic
  Analytic related insight to be gained as a result of data processing.
- Application
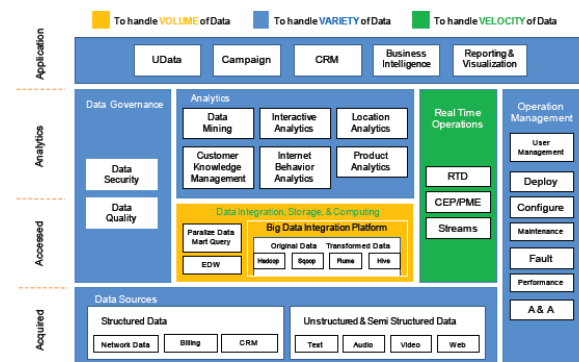 Is the final stage, where do visualization and reporting of analytical results to support decision making?

Figure 4. Four elements in Big Data Technology

Implementation of Big Data In Telkom Company

Some use cases of Big Data Telkom among others include: *Government Social Media Monitoring, Access Point Deployment Recommendation, Monetizing SME, Customer Voice Management, Broadband Churn Prediction, Automatic Meeting Resume, Integrated Channel Offering,*
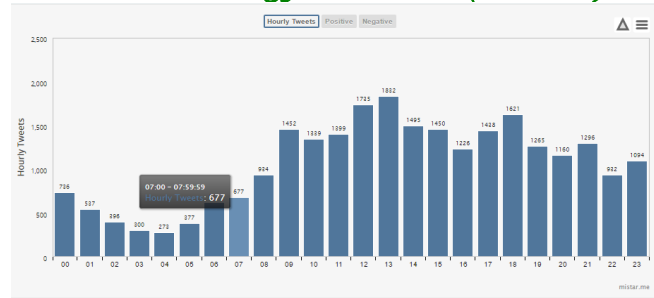
Post Call Marketing and Insurance Customer Acquisition etc.

A. Use Cases Social Data Analysis

1)   Government Social Media Monitoring

City Monitoring from social media aims to monitor related to crime, congestion, waste problems, fires, floods and direct public complaints listening.

Social media is an application on the cloud that enables users to share / post content (text, photos, and video) into the public domain. Specific analytical methods are needed to gain insight from millions of posts on social media and news especially against a popular topic being discussed in social media at any given moment. The Output from web-based applications can be displayed based on the monitor screen Command Center / Control Room or accessed via a personal computer (PC), laptop, or tablet.

Figure 5. Tweet / Post on social media by gender and Sentiments Analysis

The result of analysis within the last 30 days of popular topic in Bandung district is about flooding, with 62% male gender to tone negative sentiment. [11]

Graph 1. The Daily Tweet

Graph 2. The Hourly Chart Tweet

Daily tweet chart illustrates that talks' Bandung district rose significantly on 13th March with the topic of flooding. On the Hourly Chart tweet, we could see that everyday Bandung's citizens actively began at 08:00 until 23:00 hours and the most active during the day hours (12:00 to 13:00).

2)   Residents Happiness Index

By using Big Data, the local government can take measurements Happiness Index based on sentiment come up from Tweet Residents her. Tweet / post townspeople in social media can be analyzed to measure the index of the level of happiness of those people. In the graph below are showed the ratio happiness of citizens per district in Bandung at any given moment.
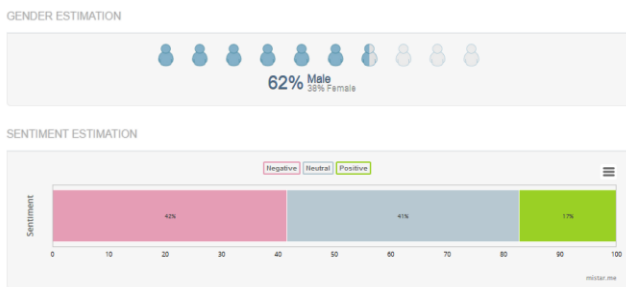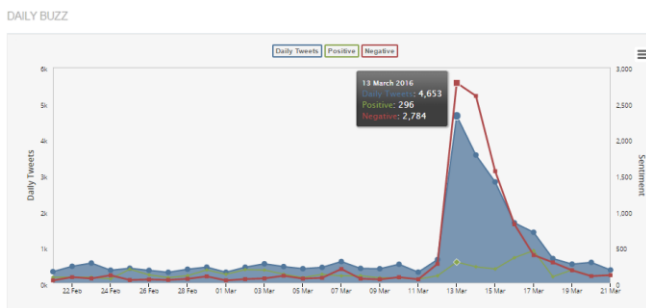

**Figure 6. Residents Happiness Index Bandung at a certain moment**

B. Use Case Access Point Deployment Recommendation

Access Point (AP) is the wireless fidelity (WIFI) which provides access to an intranet or the Internet for its users. For monetization, AP placement must be precise locations and supported by a broadband internet access.

Access Point placement recommendation aims to provide insight the right spot for the installation of the AP, recommendation to increase the number of AP is based on the prediction of the traffic, the increase traffic utilization AP by 50% and to offer a range of services Value Added Service (VAS) as appropriate.
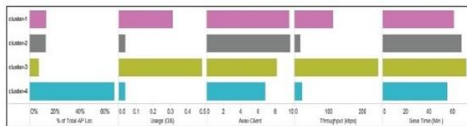
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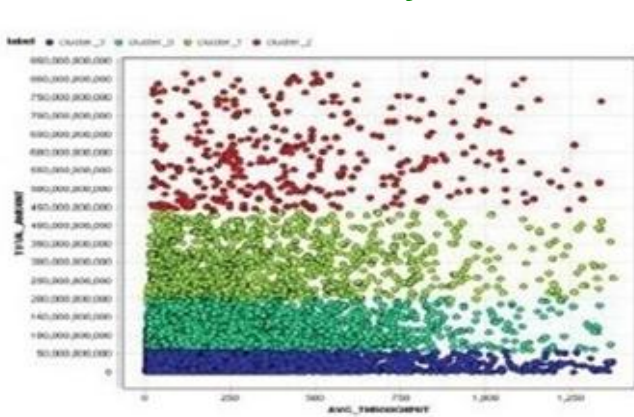
Graph 3. Analysis Results of Average Throughput vs. Revenue and divided into 4 clusters

It is seen that the deployment is dominated by Average Throughput AP with low to medium to produce small to medium Revenue.

**Graph 4. Cluster AP based on AP Number, Occupancy, Client, Throughput and Session**

Graph 5. Prediction Occupancy AP in a particular location for Strategy Optimization

C. Use Case Profiling SME

The purpose of the use of Big Data upon SME segment data is for profiling the one in order to do appropriate, acquisition new customers and leveraging existing customers.

The source data can be obtained from the Customer profiles (customer demographics), Product portfolio, Network Performance, Customer Complaint history and customer behaviour (billing, payment, and usage).
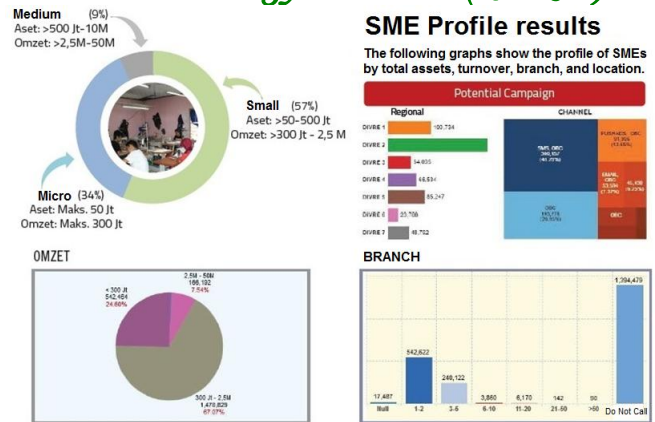
Graph 6. SME Profile Results

D. Use Case Customer Voice Management

The purpose CVM's is to get the customer's voice in finding the root cause of customer problems, obtain customer feedback to be material in the innovation and dig insight in order to evaluate internal programs (such as reward program, channel improvement, systems, and processes).
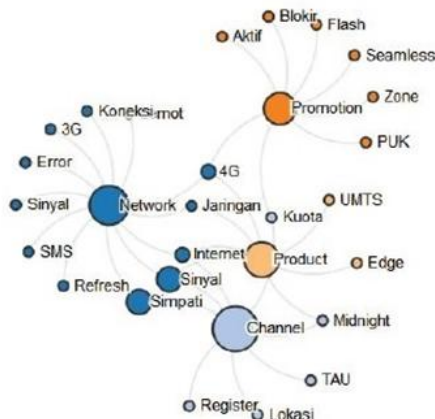

Graph 7. Root Cause

Root cause graph shows the relationship / association between words that represent the root of the problem, based on the results of monitoring social media to customers who report harassment, a complaint, or express his opinion.

Sources of data of customer profiles obtained through:

- Customer visit: when customers come to the service area or official visit to the customer.
- Inbound Call: when a customer reports of a disturbance to the Call Center.
- Email: email history between the customer and the service provider.
- SMS: customer reply SMS blast from the service provider.

- Web-in: customers manage their accounts on the web service providers.
- Social media: profiles and posting customers on social media.
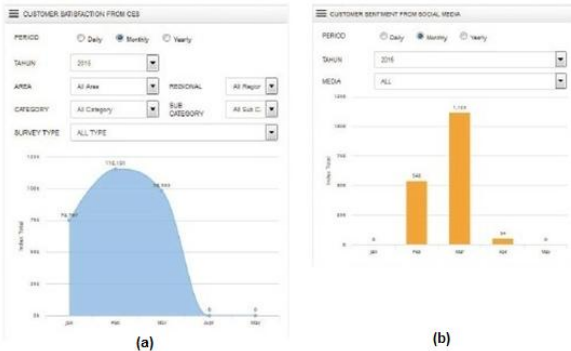
Graph 8. Customers Voice Management

Graph (a) shows the number of the customer satisfaction survey data obtained from customers with various methods of each month and graph (b) shows the amount of data used to complete customer profiles, the results of the monitoring of social media each month.

E. Broadband Churn Prediction

The objective of Broadband Churn Prediction is to reduce the churn rate of 5% to 2%, build predictive models to anticipate customers will churn, maintain existing revenue growth and manage the retention and customer loyalty programs.

The source of data used for the intended purposes including bill payments, network performance, usage patterns, a portfolio of products / services, customer profiles, customer location and customer complaints[13].
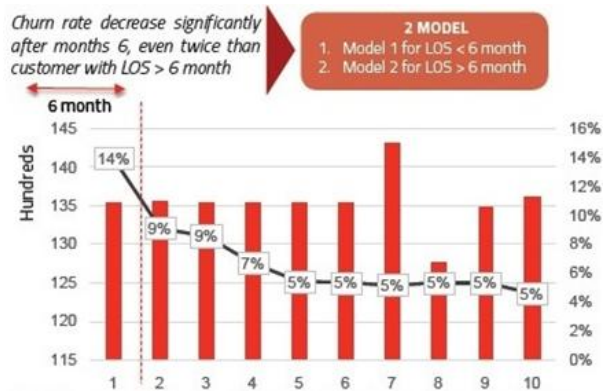
Graph 9. Customer Churn Rate based on Length of Stay (LOS)

LOS is ever a customer uses (subscribe to) those services: LOS-1 (0-6 month), LOS-2 (7-12 month), LOS-3 (13-18 month), LOS-4 (19-24 month), LOS-5 (25-30 month), LOS-6 (31-36 month), LOS-7 (37-42 month), LOS-8 (43-48 month), LOS-9 (49-54 month) and LOS-10 (55-60 month).

For example, LOS 2 has about 13.500 customers and as much as 9% (1.215) of customers are most likely to churn (for various reasons / causes).
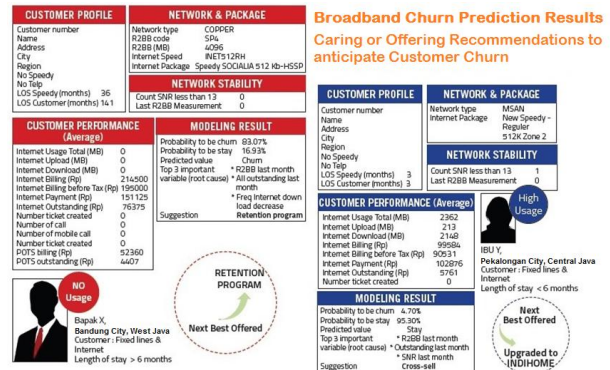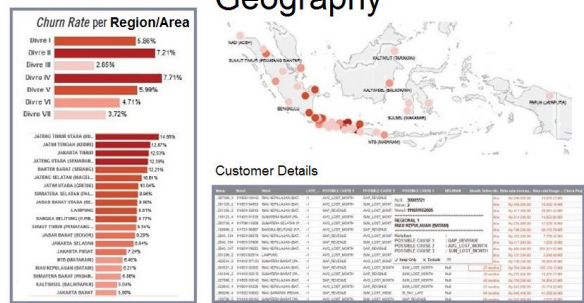

Figure 7. Broadband Churn Prediction Results

Graph 10. Churn Rate based on Geography

F. Automatic Meeting Resume (AUMER)

AUMER is a solution for personal, business unit, agency or institution whose activities are related to the talks (discussions, meetings or hearings).

This AUMER analytics aims to convert the subject of discussion, meetings or hearings into the form of a text-based file so that the workers are easier to make a resume and do documentation / filing result of the conversion so as to facilitate the search process. The unique advantages of this application are ready for use in the format of Bahasa (Indonesian language).

Features of the AUMER include voice to text conversion, Text formatting automatic, Summarization, Speaker Diarization (introduction to the process of memorizing speaker), speaker recognition complex, text search or speaker, multi-parallel, voice, streaming and live recording, cloud-based server.

G. Integrated Channel Offering

Big Data supports all channels of customer interaction to ease a business entity (enterprise), agency / institution (government) or educational institutions in managing marketing / campaign programs through various methods, recommends the right channel in doing campaign / offering based on data sources and terms of analytic and providing reports or customer response to the success of the campaign to become a material evaluation.
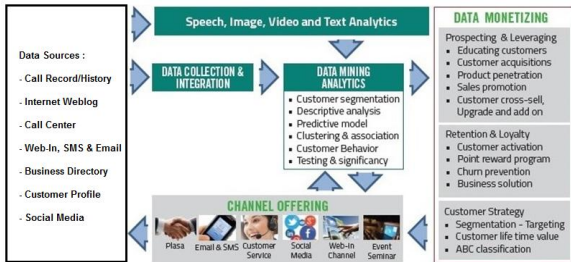

Figure 10. Integrated Channel Offering

Source of data obtained from:

* Call Record / History
  Data fixed line or mobile phone by customer
* Internet Weblog
  Internet browsing history by customer
* Call Center
  Note the subscriber interaction with the provider of the service / product, agency or institution
* Web-In, SMS & Email.
  Customer profile obtained from the interaction via the web in, SMS, or email
* Business Directory.
  List of companies associated with the particular field
* Customer Profile.
  Data matching customer profiles as campaign targets
* Social Media.
  Social media accounts that have expressed interest or are complaints about certain things

H. Use Case Post Call Marketing (PCM)

Aiming PCM performs marketing campaign or customer surveys via SMS, MMS or Outbound Call in the framework of the acquisition or retention of customers when customers finish the call. The list of marketing campaign program or customer survey was designed by the company service provider. Some of the parameters that can be set are segmentation, content, time and period. The success and failure of sending SMS and MMS related program or Customer Marketing Campaign Survey presented in graphical form and can be seen in the details.
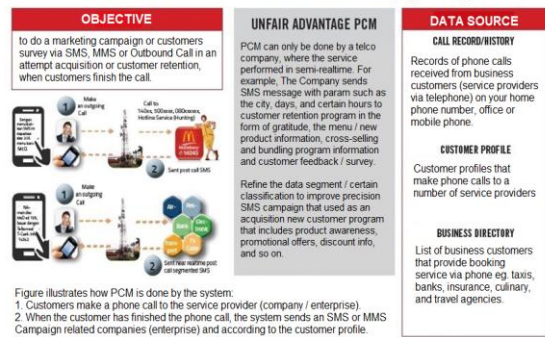

Figure 11. Post Call Marketing

I. Insurance Customer Acquisition

Insurance Customer Acquisition (INCA) aims to increase customer acquisition by:

* Marketing campaign via SMS, MMS, Email, Internet Ads, Mobile Ads, Social Media or outbound call to potential customers.
* Target prospect analysis of the data obtained with phone calls, Internet traffic, and social media.
* To facilitate polish payment is by provided a method of payment over the phone (Interactive Voice Response or IVR connected to the payment gateway and the bank issuing the credit / debit card).

Graph 1. Agent activity and level of effectivenessOutbound Call [12]

Graph 2. A Dashboard Insurance Customers Acquisition

J.   Raising Airlines Load Factor (RAILFOR)

RAILFOR aims to acquire new customers (customer acquisition), increasing Load Factor (LF) airlines, and promote a specific route for the target / right prospects. The method used in this case through:

- Target prospects obtained by performing realtime analytics to the data call, the movement of Telkomsel's mobile phone, Internet traffic, and social media activities.
- Offering Channel via SMS, MMS, Email, Internet Ads, Mobile Ads, Social Media or Outbound Call, to potential customers.
- To facilitate the payment of tickets is provided through payment method over the phone (Interactive Voice Response or IVR connected to the payment gateway and the bank issuing the credit / debit card).

Figure 12. Raising the Airlines Load Factor

Conclusions and Recommendations

Big Data Analysis solution supports Smart City Implementation can play a role in the presence of:

a. Smart City concept offers convenience in every sector of life of its citizens ranging from governance, urban planning, education, health, transportation, agriculture and more. This convenience can be realized if management performed well in which all systems integrated with each other.

b. Smart City concept not only brings the ease will be a variety of things but also efforts to safeguard the environment remains a livable city by ensuring that the city is safe and secure from any potential disasters. The City become a pleasant place to live, work and visit. So that How Big Data technology works on Smart City

quickly and accurately can give security for all citizens of various crimes and undesirable events.

c. Big Data technology allows processing of large data in a relatively short time, so give facilities for all citizens. Ease of bureaucracy, transparent data access, easy transportation access, etc. Big Data even allows guiding the vehicle to acquire a parking space in the nearby area.

d. The use of Big Data Analysis by the local government is one of the solutions for the local governments in effort to provide a rapid response and the right solution in the midst of the increasing problems of the existing town.

e. Big Data Analysis to process the facts into data that can give right supporting data in decision-making. The local government makes the data as a basis for determining its strategic measures. For example, the local government can get any resident who is an entitled or not entitled to receive subsidies through the data processed by Big Data Analysis so that the subsidy delivered to the right person.

References

[1] PT. Telkom-ITB, "Riset Pengukuran Tingkat Kematangan Smart City", Kerjasama PT Telkom dengan LAPI-ITB, Bandung, 2014.

[2] https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/20141001_IUT%20Forum%20Asia%20Bangkok_2014_Orange%20Smart%20Cities_vf.pdf

[3] http://eecs.wsu.edu/~yinghui/mat/courses/fall%202015/resources/planning-for-big-data.pdf

[4] https://ec.europa.eu/growth/tools-databases/dem/sites/default/files/page-files/big_data_v1.1.pdf

[5] https://arxiv.org/ftp/arxiv/papers/1601/1601.03115.pdf

[6] Komang B. Aryasa, "Smart Way For Your Business", Big Data Project, 2015

[7] http://www.bain.com/Images/BAIN_BRIEF_Big_Data_The_organizational_challenge.pdf

[8] Uyoyo Edisio, "Big Data Analytics and Its Application in E-commerce", 2014

[9] Jr Galbraith, Organization Design Challanges Resulting From Big Data, 2014

[10] Bruce Brenkus, "Big Data Usage at CBA", 2015

[11] Telkom, "Big Data Enabler Business & Opportunities", DDS Innovation Day, 21 Januari 2016

[12] Telkom, "Katalog Produk dan Layanan", Probis Big Data, September 2015

[13] http://conferences.oreilly.com/strata/strata-ca-2016/public/schedule / detail/46928

Biographies

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