POWER BUSINESS INTELLIGENCE DASHBOARD VISUALIZATION OF THE NUMBER OF VEHICLE LOSSES IN EAST JAVA, INDONESIA

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ABSTRAK

Provinsi Jawa Timur memiliki tingkat pencurian kendaraan bermotor (curanmor) yang tinggi dengan berbagai modus kejahatan. Perlu adanya sebuah sistem yang dapat mengolah data-data tersebut untuk membantu proses pengambilan keputusan bagi aparat penegak hukum, di dalam mengusut tindak pidana pencurian kendaraan bermotor dan mengurangi jumlah kerugian. Untuk itu, dalam penelitian ini dilakukan pengolahan data curanmor menggunakan *Business Intelligence* (BI) dan ditampilkan melalui *dashboard* Power BI. Metode penelitian yang digunakan meliputi studi literatur, wawancara, pengumpulan data, implementasi, evaluasi, dan dokumentasi. Hasil pengujian menunjukkan jumlah kasus curanmor tertinggi terjadi pada tahun 2016 (1.635 kasus) dengan mode terbanyak menggunakan kunci palsu, dan dengan merek kendaraan adalah Honda. Hasil akhir penelitian ini menunjukkan bahwa penyajian data dan informasi secara visual dan interaktif berdasarkan Power BI dapat membantu penegak hukum untuk memahami data, mendapatkan informasi, dan membuat keputusan dan kebijakan untuk menangani kasus pencurian sepeda motor.

Kata kunci: *Bussinees Inteligence*, *dashboard*, pengambilan keputusan, kehilangan kendaraan bermotor, Power *Business Intelligence*.

ABSTRACT

East Java Province has a high number of motorized vehicle theft with various modes of crime. Therefore, a system is required to process the data, which can assist the decision-making process for law enforcement officers in investigating the crime of motor vehicle theft and reducing the amount of loss. For this reason, in this research, motor vehicle theft data was processed using Business Intelligence (BI) and displayed on the Power BI dashboard. The research methodology used is literature study, interviews, data collection, implementation, evaluation, and documentation. The test results show the highest number of vehicle theft cases occurred in 2016 (1,635 cases), with the most modes using fake keys, and the highest vehicle brand is Honda. The final result of the study shows that the presentation of data and information visually and interactively based on Power BI can help law enforcers to understand data, obtain information, and make decisions and policies to handle motorcycle theft cases.

Keywords: Business Intelligence, dashboard, decision-making, motorized vehicle losses, Power Business Intelligence.

1. INTRODUCTION

Crime is a trending issue at the moment because of the many diverse modus of crime, lack of available information from law enforcement is one of the reasons people do not understand this. That makes the phenomenon of crime appear in the middle of society. Crime is an intentional act or negligence that violates a criminal/civil law that is contrary to the law [1]. The high crime rate in Indonesia is caused by various aspects that affect it, such as categories, patterns of modus crime, classification of the location of events, classification of vehicle brand victims, crime areas, and so on [2]. It can be seen that some of these aspects are interconnected.

Based on the data acquisition of motor vehicle theft cases from the data collection and processing (pullahta) Division of ICT in East Java Regional Police, shows that the number of motor vehicle loss that occurred in East Java for 5 (five) years from 2015-2019 experienced pairs retroactively, it can be seen from the number of motor vehicle losses with the highest number of cases in 2016, a total of 1.635 cases, with the highest number of cases in two-wheeled vehicles reaching 974 vehicles theft by the Honda brand, the most cases in four-wheeled vehicles reaching 75 vehicles the missing with the Toyota brand, with the most modus crime using fake keys reached 1.190 events, at the most locations on public roads with a total of 857 events, the highest number of cities/ districts in Malang reached 276 events, the highest occurrence time during the day got 356 events, in the month of most events in April got 183 incidents and based on the sex

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of the victims as many as 1.203 men and 391 women, from the data there was a decrease in the number of reports of motor vehicle loss for the following year.

The modus crime is a unique method a criminal uses to get something he wants. In the case of motor vehicle theft is a crime listed in clause 362 of the Criminal Code, the modus crime is often carried out, among others:

1. Embezzlement, stated in clause 372 of the Criminal Code is a crime usually carried out by people entrusted with or entrusted with the management of motorized vehicles, such as workshop staff and drivers who then sell or pawn the vehicle;
2. Seizure, stated in Clause 368 of the Criminal Code is when a criminal forces force the owner of a motorized vehicle or driver to surrender the vehicle;
3. Fraud, stated in clause 378 of the Criminal Code is when a criminal act as a motorized trader or an intermediary and then carries the vehicle away;
4. The forgery, stated in clause 263 of the Criminal Code is a crime committed by the perpetrators after the stolen motorized vehicle is in their hands; the crime includes:
   a) Key forgery;
   b) number plate forgery;
   c) falsification of vehicle registration and other documents such as BPKB, vehicle test certificate, ticket, model three, etc.;
   d) signature forgery;
   e) counterfeiting receipts.
5. Theft with the weight (Indonesia: pencurian dengan disertai pemberatan/curat) listed in clause 363 of the Criminal Code, theft of motor vehicles by way of dismantling, damaging, or climbing conducted at night in a closed house or entering a house that has a yard and there is a limit;
6. The theft by violence (Indonesia: pencurian dengan disertai kekerasan/curas) stated in clause 365 of the Criminal Code, namely the crime of motor vehicle theft that was preceded, accompanied by violence against people, this crime usually occurs in cases of robbery of motorized vehicle drivers.

With the rapid development of technology, the data needed to support decision-making can be easily accessed on the internet. The data collected is heterogeneous and can be processed into information to insight in real-time and knowledge that can be used in data-based decision-making processes carried out by collecting, storing, organizing, reshaping, summarizing data, and providing information [3]. Business Intelligence (BI) is one method that can be used to process data. BI can help decision-makers to get an explicit knowledge of the factors that influence an event. In addition to being able to support faster decision-making, BI can also analyze changes in trends that occur so that it helps in determining the strategies needed to anticipate changes in these trends.

Ten previous works as state of the art are related to this research. Research by [11] discusses developing a Business Intelligence dashboard for micro-retail businesses at CV. Duta Square Bandar Lampung, with the stages of business process analysis, defining problems and solutions, dashboard and system design, implementation, and evaluation. Publication by [12] describes the implementation of Business intelligence on the CV. Tangga Mas Chemical uses Online Analytical Processing (OLAP) method, making it easier for users. Research by [13]discusses the implementation of Business Intelligence at the Rokan District Health Center using Kimball-based multidimensional data modelling, which is implemented using the PHP Framework CodeIgniter and MySQL. Research by [14] discusses the implementation of Business Intelligence at Ani Clinic, Padang, West Sumatra, using Tableau and descriptive methods. The other study by [15]describes the use of Business Intelligence (BI) to help analyze and predict the spread of COVID-19. [16]describe their research, implementing Business Intelligence to analyze and visualize COVID-19 data before and after the Large-Scale Social Restrictions (Indonesia: Pembatasan Sosial Berskala Besar/PSBB). [16] uses descriptive-analytical research methodology and Tableau Public tools. Publication by [17] describes the implementation of Business Intelligence (BI) to obtain passenger flight patterns at Minangkabau International Airport using either Data Integration and Microsoft Power BI with Flight Daily Report (FDR) data. Publication by [18] describes the role of Business Intelligence which she developed to support the National Disaster Management Agency (Indonesia: Badan Nasional Penanggulangan Bencana/BNPB) in determining which provinces in Indonesia are most prone to flooding and making decisions regarding this matter. [19]describes the use of Business Intelligence based on Power BI to analyze job priorities in Indonesia to make it easier for people to find decent jobs by collecting data and information to facilitate decision-making. Publication by [20] stated the use of Business Intelligence based on Data Mining and Data Warehouse to manage the data of students who are eligible for scholarships. [20] uses the Online Analytical Processing (OLAP) method and implemented using RapidMiner, where the system can provide accurate results faster than using a database query.

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Based on previous research, no one uses Business Intelligence to deal with the problem of vehicle theft. For this reason, in this study, the main focus of research is to design and develop a Business Intelligence dashboard based on Power BI to assist the authorities in handling and making decisions related to the increase in vehicle theft cases in East Java Province.

2. THEORETICAL AND PREVIOUS WORKS

Business Intelligence (BI)

Business Intelligence (BI) is a set of theories, methodologies, processes, architectures, and technologies that transform raw data into meaningful and useful information for business purposes. BI can handle much information to help identify and develop new opportunities. Utilizing new opportunities and implementing effective strategies can provide competitive market gains and long-term stability [4] . BI is a process for extracting and collecting company operational data in a data warehouse. Thus, management can make decisions based on facts and not rely only on intuition and quantitative experience. In general, BI aims to present a variety of information tailored to the needs of each user. Such information may originate from anywhere, e.g. from a customer's purchase history, repair history data, and complaint history data [5].

BI is a series of activities to understand the business situation by conducting various types of analyses on data owned by the organization and external data from third parties. BI determine strategies, tactical business decisions, and operations and takes the measures to improve business performance [6]. There are 4 (four) Basic components of BI that synergy so that a BI can function, that is (1) Data Warehouse, a source of data from business intelligence which collects data-oriented to the subject, not changing, and has an extended period that functions in favor of management decision making, (2) Business analytic, a collection of tools to manipulate, mine, and analyze the data contained in the Data Warehouse, (3) Report and queries, which includes all forms of reporting either statically (unchanged) or dynamic according to the change of data and every kind of query that exist such as drill down, multidimensional view, grouping, and so on, (4) Data, text, and Web mining as well as top-level mathematical equipment and statistics.

Data Mining

Data mining is finding unknown relationships or information in large databases or Data warehouses using intelligent equipment. Text Mining is a semi-automated process of extraction patterns of unstructured data in large quantities. Keep in mind that the difference between text mining with data mining is that the data source of data mining is structured data contained in the database [7].

Dashboard

A dashboard is a view on one full monitor containing critical information, combining text and graphics [8]. An organization will find it challenging to manage large enough data when using effortless tools that cannot produce the correct information and cause confusion in decision-making. This paper uses the Power Business Intelligence tool to see the number of losses vehicles based on each year's crime mode.

Power Business Intelligence (Power BI)

Power Business Intelligence (Power BI) is a business intelligence application created by Microsoft that can display data visualizations, enabling queries, data connections, and reports [9] . Visualization to create Interactive reports and dashboards that depict trends, variation, and data congestion in the form of graphs, diagrams, and more. Power BI helps to connect with data, analyze and model data to present information to get a deep real-time Insight into the data that will help make better decisions. With more than 60 types of source integration with many types of data, such as Excel, text/CSV, XML, and JSON and can be connected to many database applications such as SQL Server, Microsoft Access, MySQL, Oracle, Sybase, and others. The resulting visualization can be the chart area, bar, matrix, pie, etc.

Power BI is a cloud-based data analysis of various data sources that can be used for data analysis and reporting. Power BI is user-friendly, works and is easy to master for users in analyzing data. Enterprise system business developers can use Power BI for modelling scenarios and complex data combinations [10]. The flow of activities in Power BI is as follows:

1. Desktop, input data into the Power BI desktop application in the Build report.
2. Service/web, publish reports created on power bi Desktop to power bi Service for dashboard creation, and share dashboards made following the essentials in real-time.
3. Mobile, view Insights in real time on dashboards using Power BI Mobile.

Research Methodology

This research uses research methodology. In this research, the formulation methodology is obtained through the following stages:

1. Literature Study.
   The stage of the literature study begins with finding data and information related to the theft crimes of vehicles in East Java that can be used as support in the drafting process.

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2. Interviews and Data Retrieval.
   This stage is conducting interviews on the part of the data collection and processing (Pullahta) ICT field of East Java Polda to know the data on the number of numbers losses a motor vehicle in East Jawa.
3. Application implementation.
   At this stage, data mining is conducted that aims to extract information and knowledge from data. Further visualization of the dashboard using the Microsoft Power BI application;
4. Evaluation.
   This stage interprets and evaluates the already-mining pattern from the data. The data is processed, analyzed and converted to form the knowledge. The method used for the evaluation is both Data Warehouse and Data Mining, and the evaluation result is knowledge and insight.
5. Documentation.
   This stage will document the activities that have been done and output the output generated at each stage to construct conclusions and suggestions.

Figure 1 shows a flowchart of the formulation of the research methodology as described above.

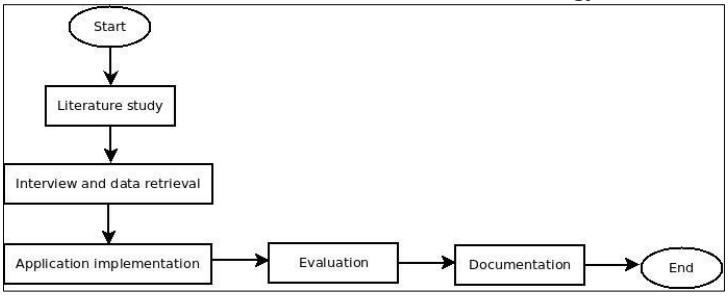

Figure 1. The flowchart of the formulation of the research methodology

The authors use the data from 2015-2019. Data used in this study were on the part of the data collection and processing (Pullahta) ICT field of East Java Polda to know the number of vehicle thefts in East Java. We are entering the data retrieval stage by copying a monthly report of each Polres in the East Java region in Excel format (.xls) from 2015- 2019. The Data obtained is a monthly report from 39 Polres of East Java Regional Polda. Attributes of existing data in the form of information of each Polres, pattern crime mode, location patterns of events, time patterns of events, vehicle brand patterns, and gender patterns of victims from 2015 to 2019.

3. RESULT AND DISCUSSION

Data Processing and Visualization

This discussion is about the description of the data processing amount of the number of losses vehicles in East Java from the year 2015 to 2019 so that later obtained the output in the form of graphical mode crime crimes against the theft of motor vehicles. In the future, Polda Jatim can map the theft of vehicle based on the location of the incident and modus crime to suppress the numbers of vehicle thefts and make the community warier about the behavior of the crime syndicate theft of motor vehicles.

The process of presenting the information data to be analyzed and visually understood in the Power BI application is as follows:

1. Measure
   Measure in the visualization of Power BI data using grouping based on victim facts, modus crime facts, fact location events, City Facts Genesis, Office facts Polres, Feed timing Events, and the fact type of vehicle;
2. Visualization
   The visualization used for developing Business Intelligence (BI) models to prepare the paper is graphs and text, then displayed on the dashboard. The following is a dashboard for the last 5 (five) years of collected data from the data warehouse visualization that can be viewed in Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, and Figure 7.

The information presented on this dashboard is information about the total number of vehicle thefts consisting of graph reports, text, folders, and data clusters based on the following:

1. Unity (Office of Polda East Java and all ranks of SPKT Polres in the jurisdiction of East Java) at the time of victim report;
2. hours/pull Hour of the incident (in the morning, noon, afternoon, evening, evening, early evening);
3. incident Time (day, date, month, year, Weton Market);
4. location of the incident (public road, house, parking lot, place of worship, office yard, etc.);

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5. city/ county Genesis (all cities and counties in East Java);
6. the modus crime (embezzlement, fake keys, deprivation, fraud, looting, theft, and others);
7. types of vehicles (motorbikes, sedans, station wagons, minibuses, pickups, trucks, and buses);
8. number of wheels (2 Wheels, 3 Wheels, and 4 Wheels or more);
9. vehicle brands (Honda, Yamaha, Suzuki, Kawasaki, Toyota, Daihatsu, Isuzu, and others);
10. vehicle type (Vario, Jupiter, Jazz, Avanza, Xenia, and others);
11. year of manufacture of motorized vehicles for victims;
12. vehicle colors (black, red, blue, yellow, silver, and others);
13. the sex of the victim.

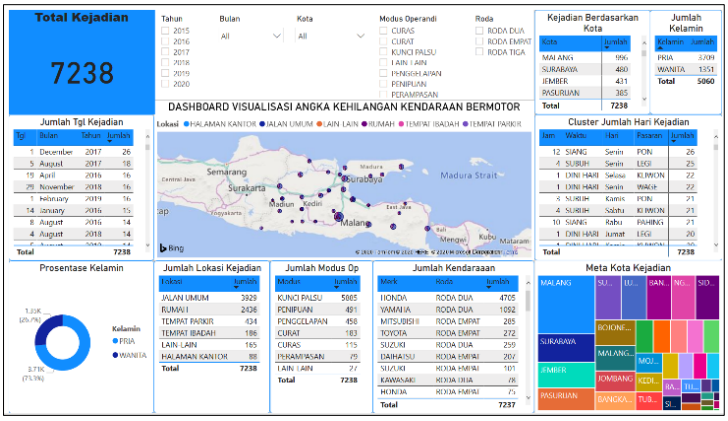

Figure 2. Dashboard total number of vehicle losses in east java from 2015 to 2019

Figure 2 includes a dashboard for the number of motor vehicle losses in East Java from 2015 to 2019, with 7238 reported cases, with the highest incidence in Malang Regency with 996 cases. As can be seen from the dashboard above, the highest number of cases in two-wheeled vehicles reached 4705 vehicles losses by the Honda brand, the most cases in four-wheeled vehicles reached 285 vehicles losses by the Mitsubishi brand, with the most modus crime using fake keys reaching 5885 events, at the location of public road events with the number 3929 events, the most occurrence at noon around midnight on Monday the pound market number of 26 events, the most occurrence date on December 1st in 2017 the number of 26 events and based on the sex of the victim numbered 3709 men and 1351 women.

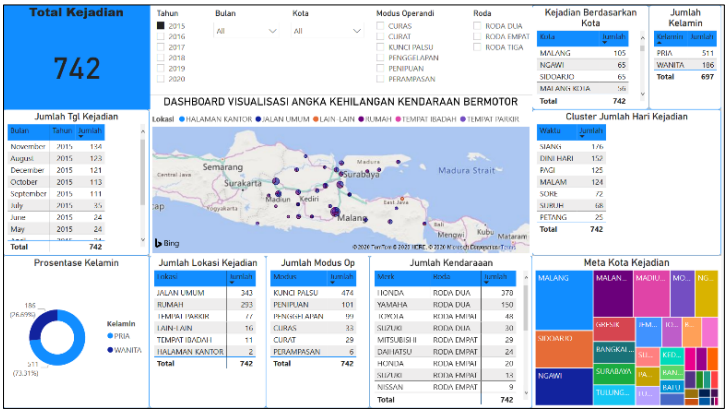

Figure 3. Dashboard total number of motor vehicle losses in east java in 2015

Figure 3 loading dashboard total number of motor vehicle losses in East Java in 2015 a total of 742 cases reported. As can be seen from the dashboard above, the highest number of cases in two-wheeled vehicles reached 378 vehicles losses with the Honda brand, the most cases in four-wheeled vehicles reached 45 vehicles losses with the Toyota brand, with the most modus crime using fake keys reaching 474 events, at the highest number of locations on public roads with 343 events, the highest number of cities/regencies in Malang reached 105 events, the highest number of occurrences during the day reached 176 events, the highest number of occurrences in November reached 134 events and based on the sex of the victims 511 men and 186 women.

Figure 4 loading dashboard total number of motor vehicle losses in East Java in 2016 a total of 1.635 cases reported. From the dashboard, the highest number of cases in two-wheeled vehicles reached 974 vehicles losses the Honda brand, the most cases in four-wheeled vehicles reached 75 vehicles losses the Toyota brand, with the most modus crime using fake keys reaching 1.190 events, at the highest number

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of incident locations on public roads with a total of 857 events, the highest number of cities/districts in Malang reached 276 events, the highest number of events during the day reached 356 events, in the month of events in April reached 183 events and based on the sex of the victims a total of 1.203 men and women.

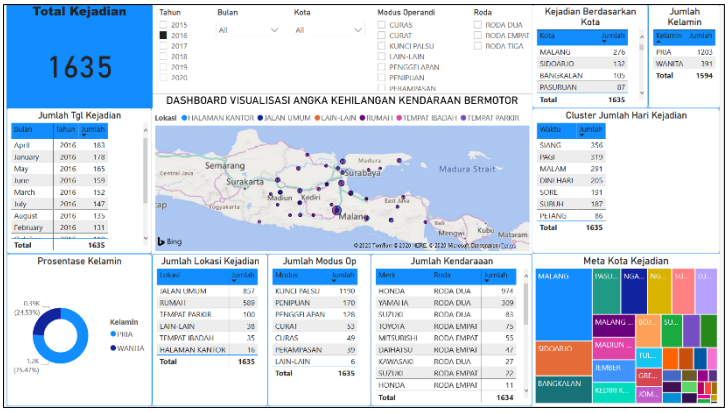

Figure 4. Dashboard total number of motor vehicle losses in east java in 2016

Figure 5 loading the dashboard number of motor vehicle loss figures in East Java in 2017, a total of 1598 case reports. From the dashboard, the highest number of cases in two-wheeled vehicles reached 1060 vehicles losses the Honda brand, the most cases in four-wheeled vehicles reached 65 vehicles losses the Mitsubishi brand, with the most modus crime using fake keys reaching 1374 events, at the highest number of incident locations with 894 events, the highest number of cities/districts in Malang reached 186 events, the highest number of events during the day reached 351 events, in the month of events the most in March reached 180 events and based on the sex of the victims a number of 779 men and 313 women.

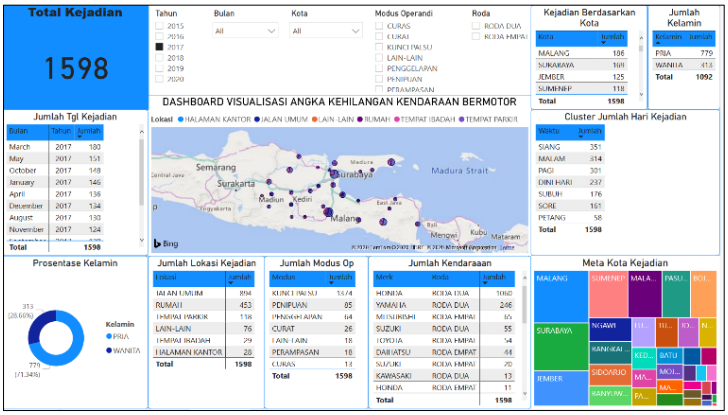

Figure 5. Dashboard total number of motor vehicle losses in east java in 2017

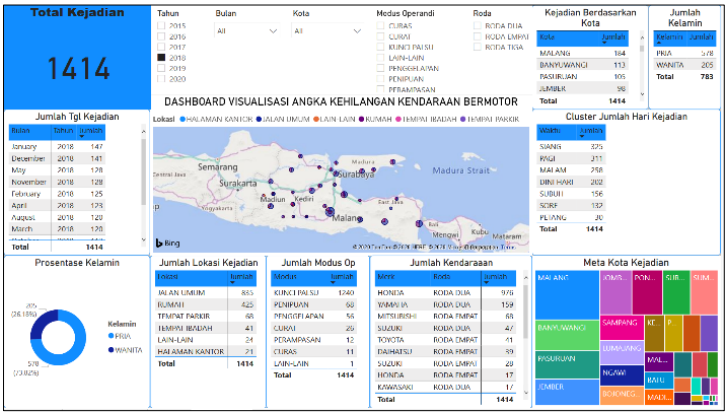

Figure 6. Dashboard total number of motor vehicle losses in east java in 2018

Figure 6 loading the dashboard the number of motor vehicle losses in East Java in 2018 a total of 1414 cases reported. As can be seen from the dashboard above, the highest number of cases in two-wheeled vehicles reached 976 vehicles losses by the Honda brand, the most cases in four-wheeled vehicles reached 68 vehicles losses by the Mitsubishi brand, with the most modus crime using fake keys reaching 1240

events, at the highest number of incident locations on public roads with 835 events, the highest number of cities/regencies in Malang reached 184 events, the most time occurred during the day reached 325 events, in the month of most events in January reached 147 events and based on the sex of the victims several 578 men and 205 women.

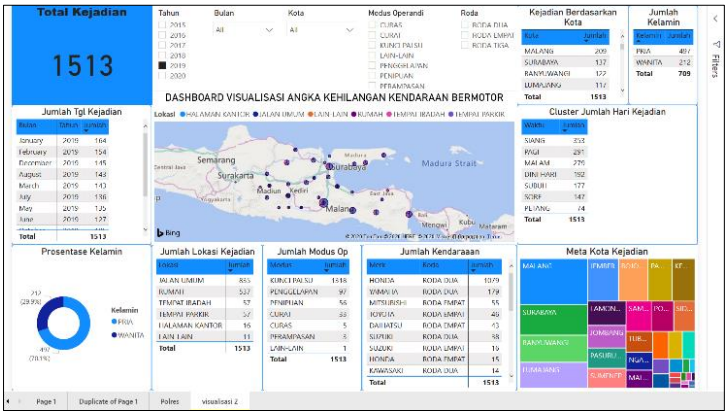

Figure 7. Dashboard total number of motor vehicle losses in east java in 2019

Figure 7 loading the dashboard the number of motor vehicle losses in East Java in 2019 total reports of 1513 cases. From the dashboard, the highest number of cases in two-wheeled vehicles reached 1079 vehicles losses by the Honda brand, the most cases in four-wheeled vehicles reached 55 vehicles losses by the Mitsubishi brand, with the most modus crime using fake keys reaching 1318 events, at the highest number of incident locations on public roads with 835 events, the highest number of cities/regencies in Malang reached 209 events, the highest number of events during the day reached 353 events, in the month of events the most in January reached 164 events and based on the sex of the victims a number of 497 men and 212 women.

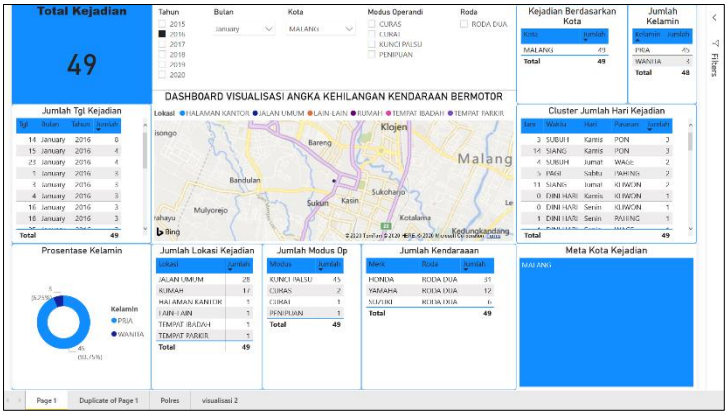

Figure 8. Dashboard total number of motor vehicle losses in east java in 2019

Figure 8 loading dashboard, the number of motor vehicle losses in East Java in 2016 reported a total of 49 occurrences at Malang Police Station. The information presented on this dashboard can be viewed based on the cluster in 2016 in most cities in Malang, it can be seen from the number of motor vehicle losses with the most cases in two-wheeled vehicles reaching 31 vehicles losses under the Honda brand, with the most modus crime using fake keys reaching 45 modus, at the location of public road events with several 28 locations, and the most occurrence cities in Malang reached 49, the most time events at dawn around 3 o'clock on Thursday the market day the number of pounds, and the highest month of events on the 14th in January there were eight events, and victims based on sex is 45 men and three women.

4. CONCLUSION

Based on the testings, the conclusions can be describe to several points, as follows: visualization can be presented in the form of a dashboard-based graph; reports on the number of motor vehicle losses at the East Java Regional Police from 2015-2019 experienced ups and downs; Polres and Polda of East Java can evaluate and take different actions using the clustering results that formed; geographical visualization supports new solutions for some purposes (seeing crime trends every year, analyzing the development of each criminal case area with all related aspects, assisting the police in designing strategies to reduce crime rates); and the population data or other public information (poverty, population density, unemployment)

affect the high crime rate; the dashboard can be used to assist users in analyzing reports and can be converted (pdf, images, tables). The implication is the dashboard can make it easier for law enforcement (Polres and Polda) of East Java, to gain insight and knowledge about the number of vehicle losses in East Java from 2015-2019 and decision-making. It also easier to view the information regarding the number of vehicle losses in East Java.

REFERENCES

[1] Law Commission of Canada, "What Is a Crime?," in What Is a Crime? Defining Criminal Conduct in Contemporary Society, Canada, UBC Press, 2004, p.30.
[2] Bureau of Justice Statistics, "www.bjs.gov," Office of Justice Programs, 2014. [Online]. Available: http://www.bjs.gov/index.cfm?ty=tdtp&tid=3. [Accessed 23-Feb-2023].
[3] C. Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making," Chichester, United Kingdom: John Wiley & Sons Ltd, 2009.
[4] Z. N. Husni, I. Mukhlash, "Implementasi Business Intelligence Pada Manajemen Report Bank XYZ," *Jurnal Sains dan Seni ITS*, Vol. 3, No.2, 2014, doi: https://doi.org/10.12962/j23373520.v3i2.7923.
[5] Imelda, "Business Intelligence", *Majalah Ilmiah UNIKOM*, 2012. [Online]. Available: https://repository.unikom.ac.id/30377/1/09-miu-11-1-imelda.pdf. [Accessed 23-Feb-2023].
[6] W. D. Suryanto, "Pengembangan Data warehouse dan aplikasi OLAP Data Tracer Study Alumni IPB Berbasis Web Menggunakan Microsoft Bussiness Intelligence", *Repositori IPB Bogor*, 2010.
[7] R. Akbar, W. Wulandari, Z. Hasanah, and H. Gravina, "Implementasi Business Intelligence Untuk Menentukan Mahasiswa Penerima Beasiswa". *Jurnal Ilmiah Rekayasa dan Manajemen Sistem Informasi*, Vol. 3, No. 1, pp. 65-69, 2017, doi: https://doi.org/10.24014/rmsi.v3i1.3374.
[8] E. Turban, J. E. Aronson, T. P. Liang, and R. Sharda, "Decision support and business intelligence systems," Pearson Education, 2005.
[9] Ronald, "Quick Intro to Microsoft Office Performance Point Server 2007," Bandung: MIC ITB, 2008.
[10]K. Gowthami and M. R. Pavan Kumar, "Study on Business Intelligence Tools for Enterprise Dashboard Development", *IRJET*, Vol. 4, No. 4, 2017. [Online]. Available: https://www.academia.edu/download/53555322/IRJET-V4I4721.pdf. [Accessed 23-Feb-2023].
[11]A. Hijriani, E. Aprilliana, R. I. A. Pribadi, D. Sakethi, "Implementasi Business Intelligence Dashboard (BID) dengan Metode ADDIE pada Usaha Mikro Bidang Retail Studi Kasus CV Duta Square Bandar Lampung," *Jurnal Matrix*, Vol. 10, No. 1, 2020, doi: https://doi.org/10.31940/matrix.v10i1.1616.
[12]B. Yap, Y.C. Giap, "Penerapan Business Intelligence Pada CV. Tanggamas Chemical Dengan Metode OLAP," *Jurnal ALGOR*, Vol. 2, NO.1, 2020. [Online]. Available: https://jurnal.ubd.ac.id/index.php/algor/article/view/465/264. [Accessed 23-Feb-2023].
[13]D. Nurmalasari, Nurzikriah, "Implementasi Business Intelligence Dashboard pada Data Pasien Puskesmas Kecamatan Rokan," *JKT*, Vol. 7, No. 2, 2021, doi: https://doi.org/10.35143/jkt.v7i2.4986.
[14]A. Zikri, J. Adrian, A. Soniawan, R. Azim, R. Dinur, and R. Akbar, "Implementasi Business Intelligence untuk Menganalisis Data Persalinan Anak di Klinik Ani Padang dengan Menggunakan Aplikasi Tableau Public," *JOIN*, Vol. 2, No. 1, 2017, doi: https://doi.org/10.15575/join.v2i1.70.
[15] N. M. Putri, I. P. R. Paramaditya, I. B. M. Swarbawa, G. L. A. Arsa, and I. B. M. Mahendra, "Implementasi Business Intelligence Untuk Menentukan Tingkat Kasus Covid-19 di Indonesia," *JELIKU*, Vol. 10, No. 1, 2021, doi: https://doi.org/10.24843/JLK.2021.v10.i01.p17.
[16]Siska, D. S. Putri, "Implementasi Business Intelligence Untuk Menganalisis Perbandingan Data Kasus Covid19 di Jawa Barat Sebelum PSBB dan Sesudah PSBB," *EDUTIK*, Vol.7, No. 2, 2021, doi: https://doi.org/10.21107/edutic.v7i2.9893.
[17]R. Akbar, V. Alfarizi, T. B. Amarta, N. N. Ardian, M. J. Ibrahim, "Implementasi Business Intelligence untuk Mendapatkan Pola Penerbangan Penumpang Pesawat dari atau ke Bandara Internasional Minangkabau," *JEPIN*, Vol. 4, No. 1, 2018, doi: https://doi.org/10.26418/jp.v4i1.25580.
[18] F. A. Sariasih, "Implementasi Business Intelligence Dashboard dengan Tableau Public untuk Visualisasi Propinsi Rawan Banjir di Indonesia", *jptam*, Vol. 6, No. 2, 2022, doi: https://doi.org/10.31004/jptam.v6i2.4715.
[19]R. Akbar, D. Rasyiddah, M. Anrisya, N. F. Julyazti, and S. Syaputri, "Penerapan Aplikasi Power Business Intelligence Dalam Menganalisis Prioritas Pekerjaan di Indonesia," *JEPIN*, Vol. 4, No.1, 2018, doi: https://doi.org/10.26418/jp.v4i1.25497.
[20]R. Akbar, W. Wulandari, Z. Hasanah, H. Gravina, "Implementasi Business Intelligence Untuk Menentukan Mahasiswa Penerima Beasiswa," *RMSI*, Vol. 3, No. 1, 2017, doi: https://doi.org/10.24014/rmsi.v3i1.3374.

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