

Optimizing digital out of home outdoor media by utilizing data to increase the effectiveness of marketing campaigns

Osly Usman^{1*}, Inkreswari Retno Hardini², Adnan Kasofi³

^{1,2,3}State University of Jakarta, Jakarta, Indonesia; oslyusman@unj.ac.id (O.U.) inkreswari.retno@unj.ac.id (I.R.H.)
adnankasofi@unj.ac.id (A.K.).

Abstract: In the last 10 years, there have been many changes in various fields around the world, especially in advertising. Over the last decade, marketers have continued to evolve dynamically to keep up with the times and the needs of their consumers. One of the advertising media that is often used to this day is DOOH, or Digital Out of Home advertisement. External media (DOOH) is a traditional advertising medium that is still widely used today. However, with the development of digital technology, DOOH needs to be optimized to compete with other advertising media. This research aims to optimize DOOH by using data to improve the effectiveness of marketing campaigns. The data used includes demographics, location, and consumer behavior. The research contributes to the field of marketing by demonstrating how data can be used to optimize DOOH and enhance the effectiveness of marketing campaigns. The data generated will later serve as a reference for marketers intending to conduct marketing campaigns using DOOH media.

Keywords: *Out-of-Home digital advertising, Data analytics, Telco data, Marketing optimization.*

1. Introduction

Out of Home Advertising is a type of digital marketing that utilizes digital media with smaller dimensions than traditional marketing tools. OOH is an important tool that is used to increase the company's turnover, companies that act as media ownership entities must also pay attention to the interests of advertisers, where they must be able to provide services and reports of significant advertising results for their interests. Currently, state-owned enterprise faces several challenges, including limited access to data that can be used to design more focused and relevant campaigns. Without sufficient data, advertisers tend to struggle to optimize their spending and increase sales conversions.

Advertising results reports can help a company identify areas where it can differentiate itself from competitors and create more value for its customers. This can include optimizing production processes, improving product quality, or improving customer service. By identifying the strengths and weaknesses in its current business model, clients can make informed decisions to improve efficiency, reduce costs, and increase profitability. For example, a company may find that certain steps in the value chain are more expensive than they should be and find ways to streamline those processes. Thus, the company can increase its profit margins and gain a competitive advantage in the market.

By conducting strategic collaboration between DOOH service providers and their clients, provider companies will benefit in several ways. First, they will get wider and deeper access to consumer data from DOOH's purchase history in a specific location, allowing them to better understand the behaviour of their target audience. This will allow them to optimize targeting and personalize advertising messages, resulting in more effective and relevant campaigns. Moreover, with in-depth data analysis, Provider companies can increase their chances of conversion and ROI. This collaboration as well

allowing Pixel to develop more innovative marketing strategies that are responsive to changing market trends and consumer behaviour. This research was conducted to see Outdoor Media Optimization (DOOH) by utilizing data to increase the effectiveness of marketing campaigns.

2. State of the Art

This research has never been conducted using telecommunication providers to determine the effectiveness of OOH which will be carried out in several places in Jakarta. Interactive technology using big data-based technology can provide data that can make an existing decision by connecting to a telecommunication provider so that a decision can be made that is interactive to the OOH. Data-driven targeting uses data analysis and geographic mapping to determine the best location for ad placement by considering target audience behaviour and demographic factors to ensure that the targeted message is effective or not. The creative and dynamic design created will contribute to the community to provide good location adjustment for the advertising place.

2.1. Outdoor Media

Outdoor advertising media (DOOH) has traditionally not occupied a large portion of advertising budgets [1]. However, overall production has increased considerably in recent years. Global DOOH ad spend reached US\$30.4 billion in 2012, is expected to grow faster than traditional advertising to US\$38 billion by Roux, et al. [2]. About US\$7.5 billion was spent on OOH advertising media in the U.S. in 2012 and is projected to grow to nearly US\$9.6 billion by Al-Lamki and Al-Lamki [3]. In short, although historically OOH advertising budgets have not been large, their spending has increased rapidly and is expected to continue to grow beyond traditional advertising.

Outdoor media is also referred to as outdoor billboards, it can be described by Lee and Johnson [4] "Media that reaches people outside the home, this includes outdoor advertising (e.g. billboards and signs) and advertising of transit facilities" [4]. Outdoor advertising is a supporting advertising medium that is part of the overall concept of a campaign.

Outdoor media, namely advertising media (usually large) that is installed in open places such as on the side of the road, in the center of crowds, or other special places, such as in city buses, buildings, fences, and so on. Types of outdoor media include billboards, ballads, posters, banners, banners, transit (bus panels), giant balloons, and others [5]. Meanwhile, according to Išoraitė and Gulevičiūtė [6] outdoor media are all advertisements that reach consumers when they are outside the home or office. Outdoor media persuades consumers when they are in public places, on the way, in waiting rooms (such as pharmacies), as well as in places where transactions occur.

2.2. Data

Definition of Data is a raw material that needs to be processed to produce information or information, both qualitative and quantitative that shows facts so that it can benefit the researcher or give the researcher an idea of a condition or a situation [7]. Meanwhile, information is a set of data that has been processed to produce an analysis to be used by those in need. Methodologically, the so-called data analysis is an activity to simplify quantitative data so that it is easy to understand. The results of the data analysis are usually in the form of data in tables, frequencies and/or cross tables, whether accompanied by statistical calculations or not. With statistical calculations, it will be seen whether the association and/or correlation between the 2 (two) variables studied does indeed occur systematically or only occurs due to the existence of coincidence factors. Meanwhile, what is called data interpretation is an activity to give meaning or meaning to data, especially based on the theories used in the research. In the meantime, the data itself has two forms, namely data in the form of numbers and data that is not numbers [8].

The abundance of data, coupled with the need for powerful data analysis tools, has been described as data-rich but information-poor. The amount of data that grows rapidly, collected and stored in large and large data repositories, has far exceeded the ability of humans to understand such data without

being able to manage it. As a result, the data collected in large data repositories becomes a "data graveyard" [9].

2.3. Marketing Campaigns

There are 5 main aspects that must be considered in campaign planning, including the goals to be achieved, the target targets, the message to be conveyed, the method to be used in conveying the message, and the method used to evaluate the activity [10].

A campaign is a person's desire to influence individual and public opinions, beliefs, behaviors, interests, and desires of the audience with the appeal of communicators who are also communicative [11]. When a company with a certain brand carries out CrM campaign activities, it will build customer suitability for the brand so that it gives rise to a positive perception of the brand [12].

2.4. Interactive Technology

The definition of interactive technology suggests that interactive technology varies substantially in its degree of interactivity [13]. Proponents of learned helplessness believe that it is possible to realign the style of negative explanations by directly 'reengineering' explanations that make pessimistic people more optimistic, and that may make older people more receptive to interactive technology [14]. The desire, practicality, and usefulness of this 'selfimprovement' approach are still debated in this context.

Kim and Forsythe stated that two consumer traits, namely anxiety about technology and innovation, can directly affect consumers' intention to use new interactive technologies, regardless of consumer attitudes towards the use of new interactive technologies. Consumers with high cognitive innovation are more likely to adopt an innovation (e.g., innovative technology). Interactive technology appears in the form of diffusion that speeds up the process, presenting obstacles. Viewing technology as an external actor ignores the way intelligence is distributed between actors and artifacts [15]. To advance interactive technology in early classes, it is important to realize that it requires professional development in the proper use of technology in the classroom, as well as opportunities to acquire technology [16].

2.5. Data Driven Targeting

Data-driven targeting is said to allow brands to reach customers more effectively and, consequently, improve financial returns [17]. Marketing strategy consists of three stages, namely segmenting, targeting, and positioning. Market segmentation is basically a strategy to understand consumer needs and wants, while targeting is evaluating and then selecting, selecting and reaching consumers who will be targeted [18]. The next process is to do positioning, which is a strategy to enter the minds of consumers so that they can form a good perception of the product in consumers. According to Susanto [19] "A database is an integrated data, which is organized to meet the needs of users in an organization" [19]. Targeting is the process of evaluating the attractiveness of each market segment to enter. The existence of good targeting will make it easier for companies to allocate products or services to consumers [20]. A system for compiling and managing records using computers, with the aim of storing or recording and maintaining complete data in an organization/company, so as to be able to provide optimal information needed by users for the sake of the decision-making process [21].

2.6. Creative Design Effectiveness

Creativity is the key to turning a weakness into an advantage [22]. The roles and responsibilities of each stakeholder are indispensable [23]. Creative design involves the process of producing original and innovative solutions that meet specific needs and preferences. Creative design is an interdisciplinary field that includes various fields such as graphic design, industrial design, architecture, fashion design, and others [24]. Creative problem-solving strategy the implementation of creative problem-solving strategies is carried out in several stages: 1) Objective Finding. 2) Fact-finding 3) Problem discovery 4)

Finding ideas 5) Finding solutions [25]. The role of creative design is a basis for making a product more recognizable to the public. Creative design includes outside door in door, the form of design is more likely to bring to life something that can be developed [26]. Producing quality designs requires smart thinking in arranging graphic elements according to good design principles by paying attention to material limitations. Therefore, creativity is needed to create creative designs. The characteristics of creative design are the ability to attract the attention of readers, the text is easy to read and understand, the written information receives visual information and emphasizes the essence of the text. region and atmosphere. The design principles are: 1. Balanced, meaning that the page must be balanced and harmonious. 2. Harmony or harmony. 3. Scale is the relative size of an object as it looks compared to other objects. 4. Rhythm or Rhythm, usually associated with the effect of movement resulting from the repetition of elements [27].

3. Methodology

Research Methods were carried out to test this research using data collection from Telkomsel providers with a specified time using a radius of 2 km at the specified place which can be seen in the figure below.

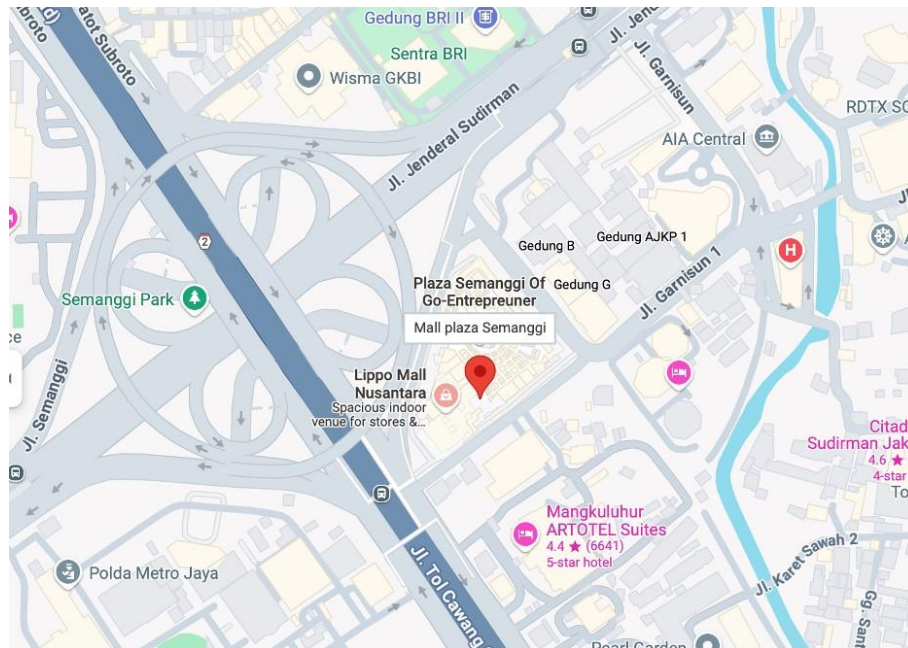


Figure 1.
Telkomsel Provider.

This research will be carried out on a protocol road that has a Videotron between Jalan Jendral Sudirman and Gatot Subroto. This research will be carried out for 6 months (from the preparation stage to the research report), namely from March to August 2024.

3.1. Variable Operation

The variables that will be taken in this Telkomsel telecommunication provider are the following variables:

Table 1.
Variabel Operation.

Demography	Psychographics	Behaviour
Age Group <ul style="list-style-type: none"> • Gender • Race • Marital status • Home / Office Location • Work • Income groups • Cellular phone 	<ul style="list-style-type: none"> • Use of the App & content • Brand/Product affinity • Social importance - Hobby • Personal values 	<ul style="list-style-type: none"> • Movement patterns • Footsteps • Point-on-interest • Travel Journey • Purchase preferences

3.1.1. Age Groups

Age group is a demographic variable that explains the classification of a respondent based on their age. The age group classification is divided into 4, namely age group 1 with a range of 20 – 29, age group 2 with a range of 30 – 39, age group 3 with a range of 40 – 49, age group 4 with a range of 50 – 59 and age group 5 for the range of 60 – 70.

3.1.2. Occupation

Occupation is a demographic variable that explains the type of work that is being carried out by the respondent. The Occupation variable explains the relationship between employment and the purpose of their coming to a location. The Occupation variable also explains the relationship between work and their lifestyle based on the places they often pass. Occupation has 5 categories, namely Entrepreneurs, Employees, Self-Employed, Civil Servants, Freelance. The following is the occupation classification code:

Table 2.
Occupation variable

T_Occupation	
Code	Assigned
OCC01	Entrepreneurship
OCC02	Employees
OCC03	Self-employed
OCC04	Civil Servant
OCC05	Freelance

3.1.3. Gender

Gender or gender is a demographic variable that explains the relationship of respondents' preferences based on gender. Gender is a common demographic variable and serves to see the distribution of respondents based on the gender who sees our ads. Gender can also be related to the places they visit frequently. Gender has 2 categories, namely Male and Female. The following is a table for gender classification:

Table 3.
Gender variable.

T_Gender	
Code	Assigned
GE01	Male
GE02	Female

3.1.4. Marital Status

Marital Status or marital status is a demographic variable that indicates whether an individual already has a relationship or not. There are 5 classifications of *Marital Status*, namely *Married*, *Single*, *Complicated*, *Divorced*, *Engaged*. This classification can show the individual's pattern of their preferences during travel. Then *Marital Status* can also explain about their movement patterns with other people, be it family or partners. The classification codes for marital status are as follows:

Table 4.
Marital status variable.

T_marital status	
Code	Assigned
MS01	Married
MS02	Single
MS03	Complicated
MS04	Divorced
MS05	Engaged

3.1.5. Income Group

Income group is a demographic variable that describes an individual's income group. The function of the income group variable is to explain the relationship between income and individual lifestyles. Income groups are divided into 3 classifications, namely Upper, Middle, and Lower. The income group classification code is as follows:

Table 5.
Income variable.

T_Income Group	
Code	Assigned
IG01	Upper
IG02	Middle
IG03	Lower

3.1.6. Device Type

Device Type is a demographic variable that describes the type of telecommunication device used by respondents. This variable is important to understand the effectiveness of out-of-home (OOH) advertising through mobile device usage patterns, which can provide information related to users' digital media preferences in various locations. The use of data from BTS providers makes it possible to track the type of devices used by respondents, aiding in understanding their patterns of interaction with digital media while in a particular location. The classification codes for device types are as follows:

Table 6.
Device type variable.

T_Device Type	
Code	Assigned
D01	Android
D02	iOS

3.1.7. Location

Location is a demographic variable that describes the geographic location of respondents when data is captured through BTS. This variable is important to measure the effectiveness of OOH advertising by correlating the physical location that respondents often visit, such as home, work, or while traveling. Using BTS data, respondents' movement patterns can be analyzed to find out how often and where they are exposed to outdoor advertising. The Location variable has three main categories, Home where respondents usually spend most of their personal time. Work that serves to understand the relationship

between daily travel and ad exposure. Commute is when a respondent moves from one place to another, usually between home and work.

Table 7.
Location variable.

T_Location	T_Location
Code	Code
LO1	LO1
LO2	LO2
LO3	Commute

3.2. Behavior

3.2.1. Movement Pattern

Movement Patterns are variables that describe the type of movement of respondents in an area. These movement patterns are important for understanding how individuals move in daily activities, such as routine travel or movement in a specific area. These variables can be classified into three, namely Commuter, which includes respondents with fixed movements between locations such as home and work or school; Circular, which includes repetitive movements within smaller areas, such as city centers or shopping areas; and Tourism, which includes respondents who are engaged in tourism activities or activities that are rarely carried out. The classification code of the movement pattern is as follows:

Table 8.
Movement patterns variable.

T_Movement Patterns	
Code	Assigned
MO01	Commuter
MO02	Circular
MO03	Tourism

3.2.2. Footfall

Footfall or visitor traffic is a variable that describes the number of people who are in a particular location in a given time span. This variable is used to measure how large a potential audience is exposed to OOH ads in the location. The footfall variable will explain the density of a PoI or Point of Interest to measure how dense the people are at the location at a certain time. The information from this variable can provide directions about the potential location of OOH that is crowded by people so that this footfall classification consists of three levels: more than 200 people, 50 to 100 people, and less than 50 people. The movement pattern classification code is as follows:

Table 9.
Footfall variable.

T_Footfall	
Code	Assigned
FO01	>2000 People
FO02	1000 - 2000 People
FO03	500 - 1000 People
FO04	100 - 500 People
F05	<100 People

3.2.3. Point of Interest

Point of Interest describes locations that are frequently visited by respondents and is used to find out the effectiveness of advertising near strategic places that are often the center of activity. These

locations can include elementary schools, high schools, universities, restaurants, supermarkets, parks, and shopping malls. The POI classification code is as follows:

Table 10.
POI variable.

T_Footfall	
Code	Assigned
PO01	Primary School
PO02	Secondary School
PO03	University
PO04	Restaurant
PO05	Supermarket
PO06	Parks
PO07	Mall

3.2.4. Travel Journey

Travel Journey describes the distance travelled by respondents in daily activities, which is very relevant to assess the effectiveness of OOH advertising on frequently travelled routes. This travel distance can be divided into several classifications, such as 0-2 km, 2-5 km, 5-20 km, and more than 20 km. The travel journey classification code is as follows:

Table 11.
Travel journey variable.

T_Travel Journey	
Code	Assigned
TR01	0 - 2 km
TR02	2 - 5 km
TR03	5 - 20 km
TR04	> 20 km

3.2.5. Purchase Preference

Purchase Preference or payment preference is a variable that describes the respondent's habit of making transactions, which is relevant to understand the preferred payment method by the audience. The classification of payment preferences consists of cards, cash, and cashless systems. The purchase preference classification code is as follows:

Table 12.
Purchase preference variable.

T_Purchase Preference	
Code	Assigned
PU01	Card
PU02	Cash
PU03	Cashless

3.2.6. Activity Time

Activity Time is a variable that describes the time range in which respondents are most often involved in certain activities or are in a location. This variable helps in understanding when is the best time to run OOH ads in order to reach your audience when they are most active. The classification consists of several time ranges, ranging from morning, noon, afternoon, to night. The activity time classification code is as follows:

Table 13.

Activity time variable.

T_ActivityTime	
Code	Assigned
AT01	06 AM- 10 AM
AT02	11 AM- 14 PM
AT03	15 PM - 19 PM
AT04	M - 00 AM

3.3. Psychographic

3.3.1. App & Content Usage

App & Content Usage is a variable that describes the types of apps and content that respondents frequently access. This variable provides an overview of respondents' digital preferences, which can be used to understand their consumption behavior in an online context. The classification includes E-Commerce, which refers to the use of online shopping applications; Social Media, which describes access to social media platforms; Financial, which includes finance-related applications; Games, which refers to digital game applications; and Streaming, which describes the use of video or music streaming services. Their classification codes are as follows:

Table 14.

App and content usage variable.

T_App & content usage	
Code	Assigned
AP01	E-Commerce
AP02	Social Media
AP03	Financial
AP04	Games
AP05	Streaming

3.3.2. Social Interest

Social Interest is a variable that explains respondents' interest in various aspects of society based on their consumption patterns. This variable helps in understanding the preferences of the community or social group that the respondent follows. The classification for this variable includes ECommerce Shoppers, which includes those who are actively shopping online; Cashless, which indicates a preference for cashless payment methods; Gamer, who describes an interest in video games; Videoholic, which refers to the intensive consumption of video content; Finance Enthusiast, who shows interest in financial topics; and Home Decor, which illustrates the interest in home décor.

Table 15.

Social interest variable.

T_Social Interest	
Code	Assigned
SI01	E-Commerce Shopper
SI02	Cashless
SI03	Gamer
SI04	Videoholic
SI05	Finance Enthusiast
SI06	Home Decor

3.3.3. Brand / Product Affinity

Brand/Product Affinity is a variable that describes a respondent's relationship or preference for a particular category of brand or product. This variable is useful for finding out the tendency of respondents to choose products or brands that they like. This affinity classification includes E-Commerce, which refers to a preference for brands in the field of online commerce; Entertainment,

which describes a tendency towards entertainment products or services; and House Related, which includes a preference for products or services related to household needs.

Table 16.
Brand variable.

T_Brand / Product Affinity	
Code	Assigned
BR01	E-Commerce
BR02	Entertainment
BR03	House Related

3.3.4. Hobby

Hobby is a variable that describes the activities that respondents often do in their free time. This variable helps to understand the respondents' interests outside of professional or daily activities. The classification of hobbies includes Sport, which includes an interest in sports; Art, which shows interest in artistic activities; Religion, which describes religious activities;

Science, which shows interest in science; and Self-improvement, which refers to efforts to develop oneself or improve personal skills.

Table 17.
Hobby variable.

T_Hobby	
Code	Assigned
HO01	Sport
HO02	Art
HO03	Religion
HO04	Science
HO05	Self-Improvement

3.3.5. Personal Value

Personal value is a variable that describes the personal values possessed by the respondent, which reflects aspects of their character or personality. This variable is relevant to understand the motivation behind their decisions in various aspects of life. The classification of personal values includes Creative, which shows creativity as the main value; Loyal, which refers to loyalty; Religious, which describes attachment to religious values; Critical, which shows a tendency to think critically; and Initiative, which describes a proactive and proactive attitude.

Table 18.
Personal value variable.

T_Personal Value	
Code	Assigned
PV1	Creative (10%)
PV2	Loyal
PV3	Religious
PV4	Critical
PV5	Initiative

4. Results and Discussion

4.1. Prospects and Impact of Benefits

This research focuses on optimizing digital outdoor media (digital out of home / DOOH) by utilizing data to increase the effectiveness of marketing campaigns. This research is expected to have a number of prospects and impacts of benefits for the development of science and for related parties, including:

- **Prospects for Science Development** The results of this research are expected to enrich the study of digital marketing science related to the use of data in increasing the effectiveness of DOOH campaigns. The resulting DOOH advertising optimization model can also be a reference for similar research in the future.
- **Product Development Prospects** the DOOH advertising optimization model resulting from this research has the potential to be developed into a software product that can be used commercially by industry players. The development of this product will be a prospect for the second year of research.
- **Economic Impact** With the increase in the effectiveness of DOOH campaigns, the optimization model resulting from this study can help increase the conversion and return on investment (ROI) of campaigns. This has an impact on increasing sales and economic benefits for industry players.
- **Social Impact** Socially, the model generated from this study can help create jobs and sources of income in the digital marketing creative industry. In addition, increasing the effectiveness of the campaign has the potential to increase public awareness of the social issues being promoted.

Thus, this research has prospects as well as various positive impacts and benefits, both academically and practically. The results of the research are expected to contribute to the development of science as well as provide benefits to related stakeholders.

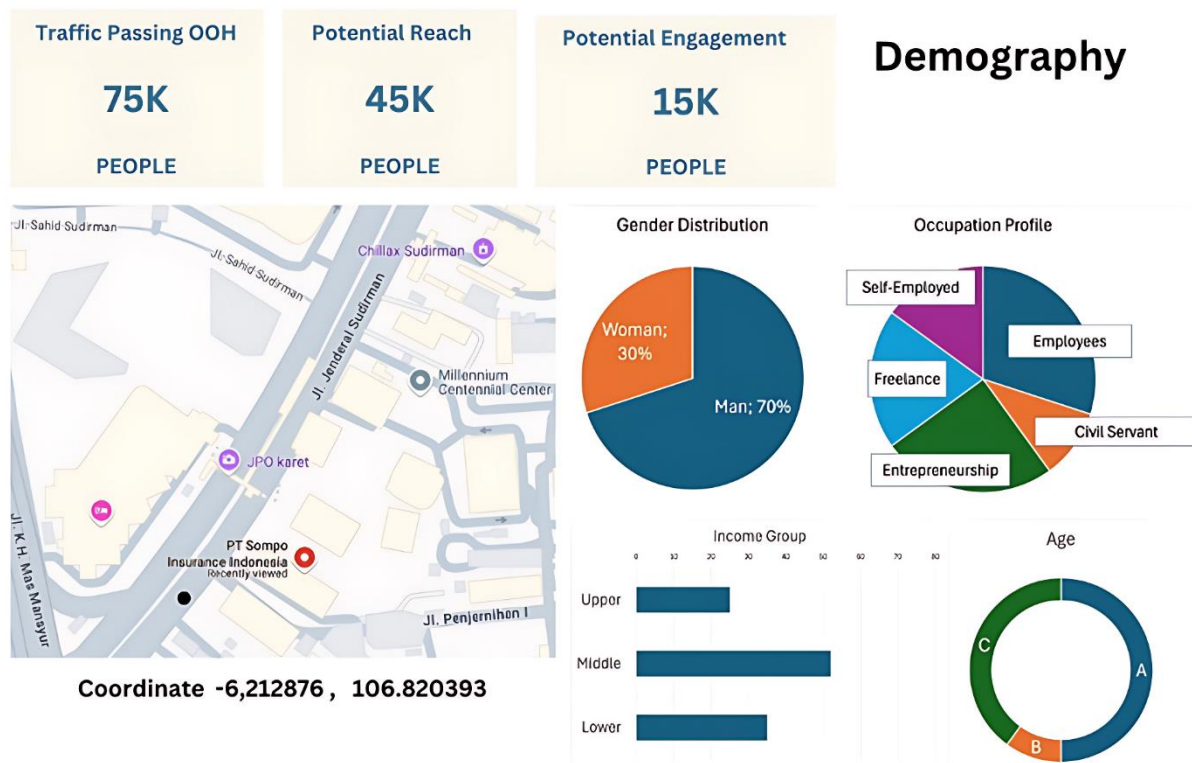


Figure 2.
Demography.

The following image is a dashboard mockup that describes the data obtained from data collection at the DOOH points in the Supraprto and Gatot Subroto protocol road areas. This dashboard specifically describes the results of the collection of research data in terms of the demographics of the individuals recorded. The information provided is in accordance with the demographic variables described in 4.1 and provides an overview of what community groups have passed the OOH point. The classification of

community groups is divided by gender, occupation, income group, and age. From the results of this data analysis, it can be seen whether the ads served are in accordance with the target audience based on demographic criteria, providing more detailed and accurate results from DOOH advertising. The insights obtained can also be considered for potential clients later who want to advertise their products or services at that point.

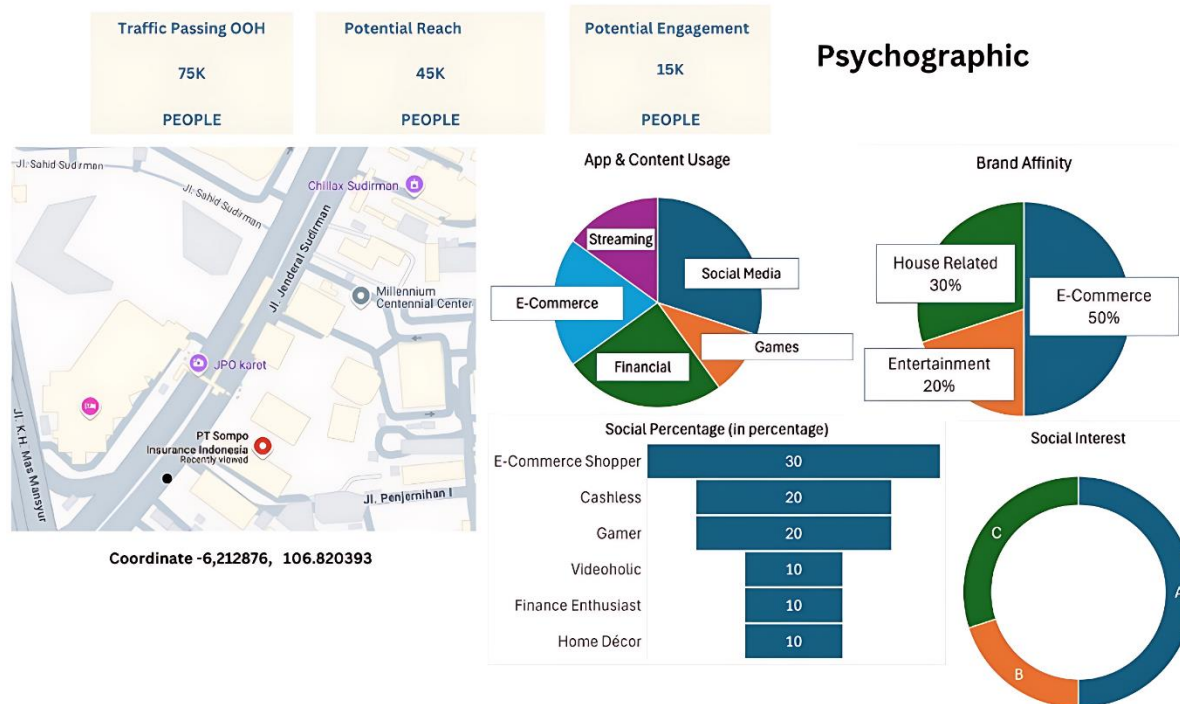


Figure 3.
Psychographic.

In addition to demographic data, there will be a dashboard that explains the characteristics of individuals who pass the OOH point or called psychographic. This psychographic dashboard provides information to stakeholders related to individual preferences such as the use of applications and social media, brand affinity or the level of tendency to choose a brand, social interests, to personal values owned by individuals based on their activities on the internet. Psychographic data is interconnected, so it is necessary to conduct a multidimensional analysis of each of the existing variables to provide insights related to the classification of what communities often pass the OOH point based on their social and personal preferences. People are more likely to be interested in ads that match their personality, so psychographic data plays an important role in determining the success of an ad when it wants to be placed in an OOH.

This research focuses on optimizing digital out of home (DOOH) media by utilizing data analysis to improve the effectiveness of marketing campaigns. Based on the results of the research that has been carried out, some of the main conclusions that can be drawn are as follows:

4.1.1. Use of Demographic Data and Consumer Behavior

By leveraging demographic, location, and consumer behavior data, DOOH media can be optimized to target audiences more precisely. Data obtained through collaboration with telecommunications service providers shows that more specific advertising according to the characteristics of the audience in a location has a positive impact on the level of engagement and effectiveness of marketing campaigns.

4.1.2. Effectiveness of Interactive Technology in DOOH

Interactive technology used in DOOH media increases the attractiveness of advertising for consumers. The results show that interactivity, such as dynamic visual elements and content that can be adapted to the context of the location, encourages audiences to pay more attention and engage with ads. This contributes to increased conversions of marketing campaigns.

4.1.3. Data-Driven Targeting Success

Data-driven targeting using real-time data analysis and geo-mapping has proven to be effective in determining the optimal location for ad placement. This study shows that location determination based on consumer behavior and demographics results in more relevant and significant campaigns in increasing return on investment (ROI). Overall, this study shows that optimizing DOOH by leveraging data can significantly improve the effectiveness of marketing campaigns, both in terms of audience engagement and marketing cost savings.

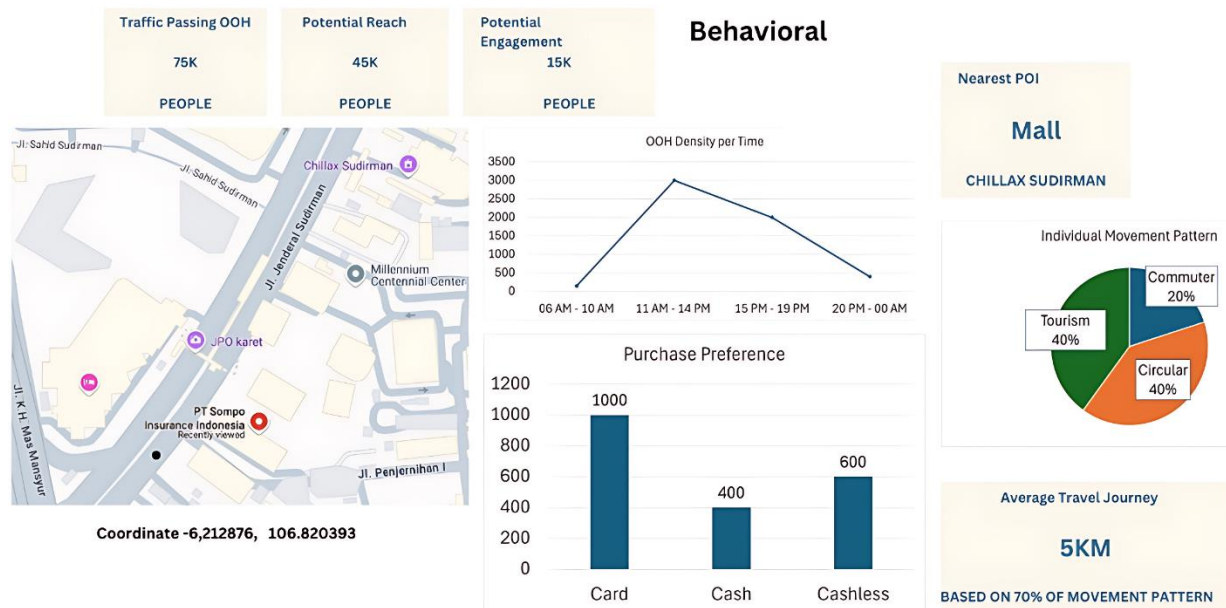


Figure 4.
Behavioral.

Then to further explain how the movement pattern at the OOH point is, the behavioral data in a dashboard is explained as shown above. Behavioral data is data that explains movement patterns, the purpose of an individual's movement, the density of a location, and other behavioral data related to individual movement. The dashboard above will explain information about the crowd conditions that are happening at the OOH point. The data explained is in the form of OOH density data over time, individual movement patterns, average distance travelled by individuals when passing through the point, individual purchase preference, and the nearest Point of Interest (POI) of the OOH. OOH density data provides information related to OOH density patterns, providing which timeframe has the most traffic at the OOH point. Then the POI data provides information about places that may be the destination of individual traffic when passing through the OOH point. Individual movement patterns explain the purpose of individual movement when passing through OOH points, whether the pattern rotates between 2 points and occurs frequently (circular), only a few times (commute), or only individuals who are passing by once (tourism).

5. Conclusion

This study focuses on optimizing Digital Out of Home (DOOH) media by leveraging data to enhance the effectiveness of marketing campaigns. Based on the findings, several key conclusions can be drawn:

5.1. Utilization of Demographic and Consumer Behavior Data

By utilizing demographic, location, and consumer behavior data, DOOH advertisements can be more accurately targeted. This leads to a positive impact on audience engagement and improves the overall effectiveness of marketing campaigns.

5.2. Effectiveness of Interactive Technology

Interactive technologies applied to DOOH, such as dynamic visual elements and location-based content, effectively capture audience attention. This interactivity enhances advertisement conversion rates and creates campaigns that are more relevant to consumers.

5.3. Success of Data-Driven Targeting

Data-driven targeting, utilizing real-time analysis and geographical mapping, has proven effective in determining optimal locations for ad placements. This strategy increases return on investment (ROI) and delivers more efficient marketing campaigns.

5.4. Prospects and Benefits of the Study

The optimization model developed through this study can serve as a reference for industry practitioners and academics in leveraging data for marketing purposes. Additionally, the findings are expected to contribute to economic benefits by reducing marketing costs and creating job opportunities within the creative industry.

This research demonstrates that strategic data utilization in DOOH media significantly enhances marketing effectiveness, both in terms of audience engagement and cost efficiency. The results of this study are expected to provide a valuable contribution to the development of digital marketing knowledge and its practical application in the advertising industry.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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References

- [1] J. Cho, Y. Cheon, J. W. Jun, and S. Lee, "Digital advertising policy acceptance by out-of-home advertising firms: A combination of TAM and TOE framework," *International Journal of Advertising*, vol. 41, no. 3, pp. 500-518, 2022. <https://doi.org/10.1080/02650487.2021.1888562>
- [2] T. Roux, I. R. D., and D. W. Van, " Out-of-home advertising media: Theoretical and industry perspectives," *Communitas*, vol. 19, pp. 95-115, 2014.
- [3] N. Al-Lamki and L. Al-Lamki, "International accreditation of postgraduate medical education: Whither its role in Oman?," *Oman Medical Journal*, vol. 31, no. 1, p. 1, 2016. <https://doi.org/10.5001/omj.2016.01>
- [4] M. Lee and C. Johnson, *Basic principles of advertising in global perspective, 1st Ed., 3rd printing*. Kencana: Jakarta, 2011.
- [5] A. Waheed and J. Yang, "The effect of e-marketing and outdoor media advertising on exploratory consumer buying behavior," *International Journal of Customer Relationship Marketing and Management*, vol. 8, no. 1, pp. 30-48, 2017. <https://doi.org/10.4018/IJCRMM.2017010103>

- [6] M. Išoraitė and G. Gulevičiūtė, "Entrepreneurship and sustainability issues outdoor advertising effectiveness evaluation from customers' views," vol. 10, 2023. [https://doi.org/10.9770/jesi.2023.10.3\(1\)](https://doi.org/10.9770/jesi.2023.10.3(1))
- [7] S. Singh, "Natural language processing for information extraction," Retrieved: <https://arxiv.org/abs/1807.02383v1>. [Accessed 2018].
- [8] M. Islam, A. Hossain, R. Hasan, and A. R. Soton, "The methods, benefits and problems of the interpretation of data," presented at the 2020 International Conference on Information Science and Communications Technologies, ICISCT 2020, Nov. 2020. <https://doi.org/10.1109/ICISCT50599.2020.9351400>, 2020.
- [9] T. J. Skluzacek, K. Chard, and I. Foster, "Automated metadata extraction: Challenges and opportunities," in *Proceedings - 2022 IEEE 18th International Conference on e-Science, eScience 2022*, pp. 495–500, 2022. <https://doi.org/10.1109/ESCIENCE55777.2022.00088>, 2022.
- [10] H. Getachew-Smith, A. J. King, C. Marshall, and C. L. Scherr, "Process evaluation in health communication media campaigns: A systematic review," *American Journal of Health Promotion*, vol. 36, no. 2, pp. 367–378, 2022. <https://doi.org/10.1177/08901171211052279>
- [11] W. M. Junk and A. Rasmussen, "Are citizens responsive to interest groups? A field experiment on lobbying and intended citizen behaviour," *West European Politics*, vol. 47, no. 7, pp. 1643–1669, 2024. <https://doi.org/10.1080/01402382.2023.2229710>
- [12] M. Handa and S. Gupta, "Digital cause-related marketing campaigns: Relationship between brand-cause fit and behavioural intentions," *Journal of Indian Business Research*, vol. 12, no. 1, pp. 63–78, 2020. <https://doi.org/10.1108/JIBR-092019-0285/FULL/PDF>
- [13] M. Jevremović *et al.*, "Predicting user behaviour based on the level of interactivity implemented in blockchain technologies in websites and used devices," *Sustainability*, vol. 14, no. 4, p. 2216, 2022. <https://doi.org/10.3390/SU14042216>
- [14] L. Lee and M. L. Maher, "Factors affecting the initial engagement of older adults in the use of interactive technology," *International Journal of Environmental Research and Public Health*, vol. 18, no. 6, p. 2847, 2021. <https://doi.org/10.3390/IJERPH18062847>
- [15] D. Tverskoi, S. Babu, and S. Gavrillets, "The spread of technological innovations: Effects of psychology, culture and policy interventions," *Royal Society Open Science*, vol. 9, no. 6, p. 211833, 2022. <https://doi.org/10.1098/RSOS.211833>
- [16] Y. Copur-Gencturk, J. Li, and S. Atabas, "Improving teaching at scale: Can AI be incorporated into professional development to create interactive, personalized learning for teachers?," *American Educational Research Journal*, p. 00028312241248514, 2024. <https://doi.org/10.3102/00028312241248514>
- [17] J. Yang, D. Eckles, P. Dhillon, and S. Aral, "Targeting for long-term outcomes," *Management Science*, vol. 70, no. 6, pp. 3841–3855, 2024. <https://doi.org/10.1287/mnsc.2023.4881>
- [18] B. B. Schlegelmilch, "Segmenting targeting and positioning in global markets in global marketing strategy: An executive digest." Cham: Springer International Publishing, 2022, pp. 129–159.
- [19] A. Susanto, "Database management system," *International Journal of Scientific & Technology Research*, vol. 8, no. 6, 2019.
- [20] S. Yadav and V. Kumari, "segmenting green: Exploring market segmentation and targeting strategies in sustainable marketing," *International Journal of Advanced Research*, vol. 12, no. 3, pp. 450–455, 2024. <https://doi.org/10.21474/IJAR01/18413>
- [21] M. Mukred, Z. M. Yusof, U. A. Mokhtar, A. S. Sadiq, B. Hawash, and W. A. Ahmed, "Improving the decision-making process in the higher learning institutions via electronic records management system adoption," *KSII Transactions on Internet and Information Systems*, vol. 15, no. 1, pp. 90–113, 2021. <https://doi.org/10.3837/TIIS.2021.01.006>
- [22] N. Yodchai, P. T. M. Ly, and L. T. T. Tran, "Co-creating creative self-efficacy to build creative performance and innovation capability for business success: A meta-analysis," *Creativity Studies*, vol. 15, no. 1, pp. 74–88–74–88, 2022. <https://doi.org/10.3846/CS.2022.13852>
- [23] E. Leonidou, M. Christofi, D. Vrontis, and A. Thrassou, "An integrative framework of stakeholder engagement for innovation management and entrepreneurship development," *Journal of Business Research*, vol. 119, pp. 245–258, 2020. <https://doi.org/10.1016/J.JBUSRES.2018.11.054>
- [24] V. Šuligoj, R. Žavbi, and S. Avsec, "Interdisciplinary critical and design thinking," *International Journal of Engineering Education*, vol. 36, no. 1, pp. 84–95, 2020.
- [25] L. J. Nazzal and J. C. Kaufman, "The relationship of the quality of creative problem solving stages to overall creativity in engineering students," *Thinking Skills and Creativity*, vol. 38, p. 100734, 2020. <https://doi.org/10.1016/J.TSC.2020.100734>
- [26] S. Han, Z. Shi, and Y. Shi, "Cultural and creative product design and image recognition based on the convolutional neural network model," *Computational Intelligence and Neuroscience*, vol. 2022, no. 1, p. 2586042, 2022. <https://doi.org/10.1155/2022/2586042>
- [27] M. Khorami, "Space harmony: A knot theory perspective on the work of Rudolf Laban," *Journal of Mathematics and the Arts*, vol. 14, no. 3, pp. 239–257, 2020. <https://doi.org/10.1080/17513472.2020.1751575>