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TOWARDS SOCIETY 5.0: A PILOT STUDY ON COSTLESS SMART TRANSPORTATION BUSINESS MODEL

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ABSTRACT

The goal of Society 5.0 is to create a human-centric society that solves economic development challenges so that people can enjoy an active, comfortable, and high-quality life. Society 5.0 is a society that thoroughly provides various needs of people, regardless of region, age, sex, language, etc., by supplying all the items and services required for the continuation of the society itself. This paper focuses on our attempt to facilitate transportation technology as one of the drivers to achieve Society 5.0 Sustainable Development Goals (SDGs) through Costless Smart Transportation (CST). Our approach delivered a costless transportation service for the society while still being able to provide profits to the management and business partners. Our implementation strategy of the technology is focused on tourism, education, retail, culinary, and industrial that also provides business opportunities to other sectors. The implementation of the business model is realized through a web-based administrative system and a mobile app for clients and business partners. Our pilot study has shown that the proposed business model allows all levels of society to participate and benefit from it yet allows the program to be sustainable in the long run.

Keywords: Society 5.0, SDGs, Smart Transportation, CST.

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1. INTRODUCTION

The degree of innovation for small businesses depends heavily on the willingness and aspirations of its employees to experiment with new ideas and concepts, create prototypes, and analyze opportunities for new products and services. It also depends on the degree of support that the 'experimentation of society' receives from the sponsors (e.g., successful business partners) or the government. As an example, the use of technology in Indonesia shows remarkable expansion in terms of innovation and technology solutions in recent years. Society in Indonesia is able to utilize smart technologies from Society 5.0 such as financial technology for online loans, automation technologies for small and micro businesses operation, and transportation technology for everyday

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transportation. This trend has been observed since the beginning of this century when innovative technology such as smart transportation was initially introduced to Indonesia. It is estimated that there are more than 2.1 million users using smart transportation every day (Hootsuite, 2020). However, the growth rate of the technology itself cannot equally catch up with the development of the economy especially the traditional markets, small shops, handicrafts, and tourism. This is because most of the small and medium scale sectors business owners do not have the hefty funds and the fast-changing competencies to facilitate the technologies to scale up their businesses.

1.1. Society 5.0

Society 5.0 is an initiative that aims at creating a more efficient and balanced society with the goal of improving human life quality aligning to the Society 5.0 goals. To achieve this objective, social reformation using technological innovation is highly expected and a must. Its core principle emphasizes a human-centered society that balances economic development by solving social problems through an integrated platform of cyberspace and physical space (Funabashi, 2020). This ensures a future-proof society based on the equal use of technologies that transcends generation gaps leading towards a society that respects individuals, where everyone can enjoy a high quality of life (Shiroishi et al., 2018). Not to mention that it also includes the introduction and development of new technologies and processes that enable people to live independently. These include the internet, mobile phones, digital and automation services that not only allow people to communicate ubiquitously but also provide supports in all kinds of daily activities. Society 5.0's principal ensures that society achieves a higher level of overlapping between cyberspace and physical space with sustainable development goals in mind, relying on the use of smart technologies for all the levels of the society from the poorest to the richest. This contrasts to Information 4.0, where it only focuses on a dedicated group of individuals to access and use technologies which cumulatively creates gaps within the society and causes divergence in income, business, education, social, and cultural aspects.

Figure 1: Society 5.0 Sustainable Development Goals (Shiroishi et al., 2018)

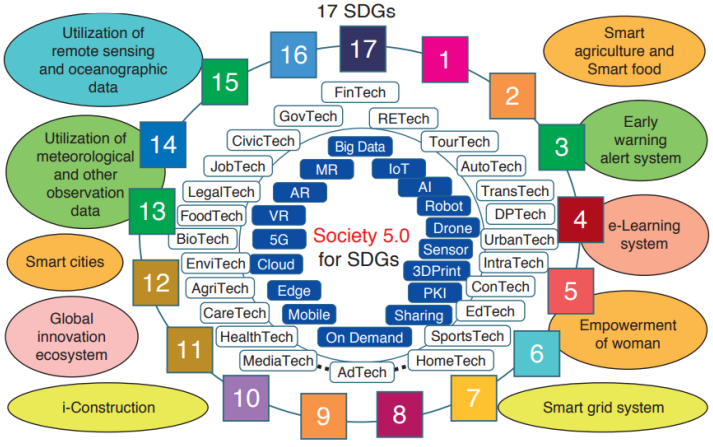


Figure 1 shows the 17 Sustainable Development Goals (SDG) goals of Society 5.0 to promote economic growth, social justice, and environmental protection. It is expected that the next generation of entrepreneurs will have a higher probability to kickstart their businesses through the use of innovative and smart technologies. These innovations will be used by society without the boundaries of intelligence, competency, income, gender, social-economic status, or any other limitations towards attaining the goal.

In the following, we intend to approach our discussion by proposing a business model providing a Costless Smart Transportation (CST) which benefits all parties from the use of technologies according to the Society 5.0 principles. We have designed and implemented the model with a startup in Balikpapan City, Indonesia, and validated it through a pilot project with the hope that this model could be a role model to be implemented in other cities as a catalyst to transform into smart cities. The startup intends to attain the Society 5.0's Transportation Technology (TransTech) SDGs in several economic aspects. In addition, the innovation attempts to increase and contributes to the use of local transport services using smart transportation and improve other sectors such as education, industry, retail, and tourism.

1.2. Smart Transportation in Society 5.0

Smart transportation is a practical approach to improve the efficiency of public transportation, involving all levels of society. This helps to increase productivity, reduce transportation costs, and expedite the process of e-economic and social development. There are many use cases on smart transportation and e-commerce that were inspired by Society 5.0 (Razak et al., 2019), the corresponding technologies might not be accessible to all levels of society. The current smart transportation model in Indonesia only allows individuals that can afford to own motorcycles and cars to participate in the available e-hauling services like Gojek and Grab. Hence, at least 9,78 % of people in Indonesia are below the poverty baseline (Central Bureau of Statistics, 2020) therefore the business competitiveness in the society is not completely fair and balanced.

Aside from the business perspective, smart transportation in Society 5.0 should also be able to integrate urban datafication and data-driven planning to design, simulate, and overcome problems that may occur in the future. This process would also help to support other corresponding smart city technologies by providing autonomous and decentralized data between them. For example, data gathered from smart transportation could be used in traffic controls and monitoring to enhance its calculation and provide better services. However, these technologies are rarely implemented in Indonesia due to a lack of promotion and encouragement in society (Firmansyah et al., 2017).

The current smart transportation in Indonesia is not integrated with smart city technologies such as traffic controls and monitoring (Wayne, 2020). Society is still using conventional traffic lights to control the traffic flow and although it is implemented with closed-circuit television (CCTV), it still needs to be monitored manually with human resources (Wulandari & Munaroh, 2020).

2. PROBLEM STATEMENTS

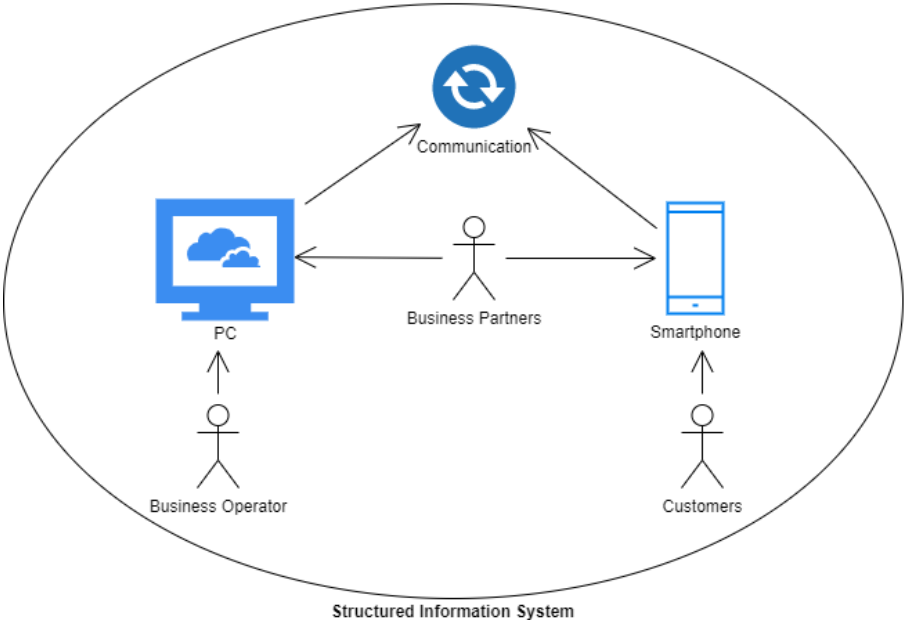
Smart transportation gives economic advantages such as an increase in Gross Domestic Product (GDP), new employment opportunities, as well as new business innovation if implemented

correctly in Indonesia, especially in the city of Balikpapan and other cities in the future. However, without a proper business model and technology adoption, with high system development and operational cost, the business is not sustainable. Below are the smart transportation problems that we have been identified in Balikpapan, Indonesia:

2.1. High Entry Cost to The Business

Current smart transportation (Gojek, Grab) incurs high system development and operation costs to participate. Figure 2 below illustrates an existing smart transportation business model that can be found in Indonesia. It has three separate main entities: customers, business partners, and business operators. Communication is carried out using personal computers and smartphones between the entities. This business requires high entry costs not only for the management but also for the business partners. The management is required to provide a set of information system platforms to different business partners and users. The business partners require operational resources such as vehicles, operational knowledge, and IT equipment which require considerable investment.

Figure 2: A Common Smart Transportation Model in Indonesia



Contradicting to the principle of Society 5.0, this model can become a burden to society since the cost of starting this business is too high and won't be available to all levels of society. Moreover, this business requires high ICT skills and competencies, which the current society is lacking.

2.2. Smart Transportation Partnership is not Available to Everyone

The smart transportation initiative in Indonesia offers society a transportation solution. However, the model is unlikely to have sound sustainable economic returns for the members of the society in the long run as it only creates impacts and benefits at the middle to a higher class of the society. The lower class of the society who cannot afford any transportation tool are not eligible to become business partners and take advantage of the sophisticated technology. Aside from the operational tool, the increase of development and use of ICT aspects in Indonesia (Safitri, et al 2020) is also the key aspect of a successful smart transportation business model. Therefore, it is necessary to initiate a new business model with which is able to open to all levels of the society yet ensures the sustainability of the technology itself but still able to give access to all levels of the society to use it.

3. MOTIVATION

The development of technologies in Indonesia according to the Society 5.0 SGDs is the primary motivation of this study. We are trying to propose a business model based on the currently available smart transportation technology. Aside from integrating technology to support Society 5.0, we also ensure that the technology can be effectively utilized between service providers and users, interventions from third parties such as private and government sectors in Indonesia are highly anticipated. Therefore, the government should play an active role to provide suitable solutions for the above-mentioned discrepancy by introducing and implementing technologies leading towards society 5.0.

4. OBJECTIVES

Our proposed study is focused on the following objectives:

1. a new business model that provides costless transportation for society while still able to give profits to the management and business partners,
2. an IT solution that is able to realize the business model, and
3. an analytic function that could facilitate the data to improve its services and effectiveness.

5. COSTLESS SMART TRANSPORATION (CST)

In the paper, we propose a Costless Smart Transportation (CST) business model, which is capable of providing economic yet efficient services to benefit entire social-economic sectors such as tourism, food & beverages (F&B), educations, local industries, and retails. This business model consists of an information system as a cyber artifact and business partners as artifacts that interact with one another through the Internet and smart technology (Möller & Vakilzadian, 2016). It also differs from the previous business model which is restricted to a certain level of society. The CST can be an alternative to the people who have no access to public transportation or for those who wanted to save costs in traveling by providing them free transportation. This allows all members of society to become business partners. Regardless of their financial situation, they will equally

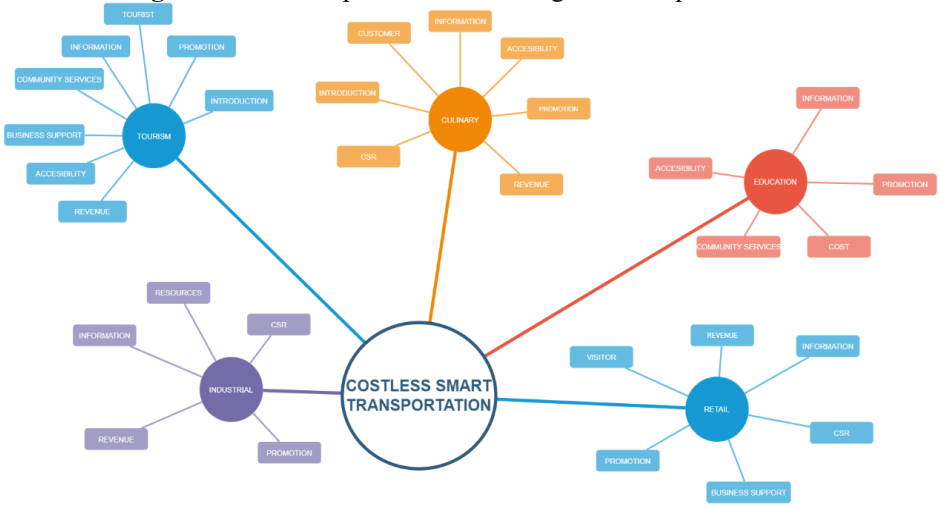
have the access to vehicles, shops, or other services in exchange for incentive to the other people of the society who provides the access.

In the near future, we foresee that the CST could also be integrated with other multi modes of transportation. It is reported that the interaction and integration of multi modes of transportation such as trains, ships, airplanes, etc., are essential for the innovation of smart transportation (Möller & Vakilzadian, 2016). CST along with multi modes of transportation is also be implemented and interact with other sectors such as culinary, education, retail, and industrial sector. These sectors are the main focuses of our implementation. Figure 3 shows the various upcoming stakeholders in our proposed CST.

We anticipate that the result and the impact of the implementation shall be varied among the different sectors, but it is obvious that the benefits of using this strategy are more than just improving efficacy. On the other hand, it can open new opportunities for developing new technologies and introducing innovations to pave the path for embracing Society 5.0 where it has progressing positive impacts on the global economy in the long run.

In the coming future, this strategy could be implemented in other sectors by analyzing, innovating, and conducting studies on the technology model. It is important to note that to achieve sustainable development, the management should not merely focus on implementation strategy alone but also on the use of technology.

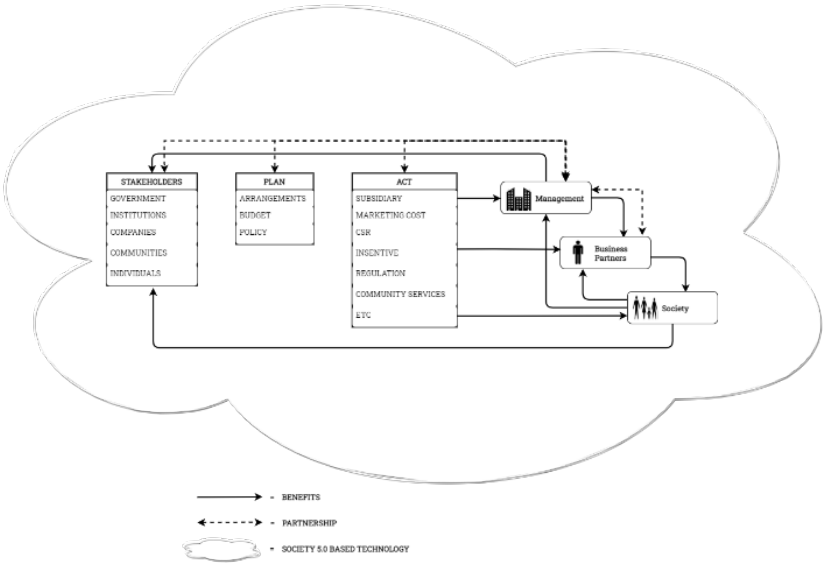
Figure 3: Sector Implementation Strategies and Impacts



In the study, we adopted a community service using a costless technologies principal as a part of the CST model in Balikpapan to support Society 5.0. CST, which aims to provide costless technologies for all levels of society while making sure that the technology providers are also able to gain profit (Roring, 2020). Figure 4 shows the stakeholders and their relationship in the sustainable CST principle. CST involves three major pillars: management, business partners, and society. Stakeholders are the parties who initiate technological innovations to solve existing

problems. In other words, they are the solution providers. The management collaborates with the business partners and focuses on business processes and administrative tasks to ensure that the solutions could be easily and widely used and accepted by society, ensuring sustainability at all levels. The management also tries to find and establish a partnership with the stakeholders and strategic business partners to accommodate their needs. For example, the management and the stakeholders can start the partnership by creating a business plan which benefits both parties: the stakeholder's budget, and policies that may set the limit of the partnership itself. A partnership could reach a mutual agreement among parties that result in a new subsidiary from the government to provide CST to its residents, performing marketing through CST instead of conventional ways, participating Corporate Social Responsibility (CSR), complementing CST to the local business transportation, etc.

Figure 4: CST Principal



In CST, the business partners are the logistic business owners and transport drivers, who are offering their services and products through an online information system. In our context, they are the transportation companies that are operating on a freelancing basis. This allows business partners to generate revenue transportation and e-hailing services while the drivers generate incomes at a charge per trip basis, focusing mainly on areas such as tourism attraction spots and dense F&B premises. The effortless approach manages to increase the number of patrons to the above-mentioned premises, this directly improves the business economics yet indirectly increases the local government's tax collection, resulting in a win-win situation. Thus, this interconnected system greatly benefits the management, initiators, and investors directly and indirectly.

The concept of CST embraces various parties such as government, institutions, state or private companies, or individuals as initiators and investors as funding parties to the innovative solutions.

In addition, third parties can use their own funds to support associated projects that are related to it. For example, the government could provide transportation subsidiaries to transportation companies for bringing visitors to various tourism spots.

In this context, CST could benefit the tenants, small and micro businesses near the tourist attraction spots. The community that uses the CST would expect growth of sales to the businesses. It could also be used to promote government programs to achieve SDGs by ensuring the tourism spots and the businesses near them always have visitors. In addition, CST's smart transportation is an innovative way to attract new business opportunities and help society, especially during the recovery period after the covid-19 pandemic, allowing rapid economic recovery to its previous state.

The smart transportation business model also embraces all levels of society becoming drivers to widen and diversify their varieties of income. It could also serve temporarily as a primary income for those who became unemployed. In addition, the management could also include universities' community service activities and companies' CSR as business partners. This could kickstart the smart transportation business model with much lower operational costs.

6. IMPLEMENTING CST

To enable a CST in Balikpapan, Indonesia, we initially carried out system requirement analysis on users, localities, and the available infrastructures data. The online information system design tends to adhere to the general smart transportation standard which includes Global Positioning System (GPS), map direction, waypoints, transportation information, alerts, etc. The CST is implemented with the following architecture: a client-server model where the main data are stored in a cloud-based database, which is illustrated in Figure 5.

Figure 5: The Architecture of CST

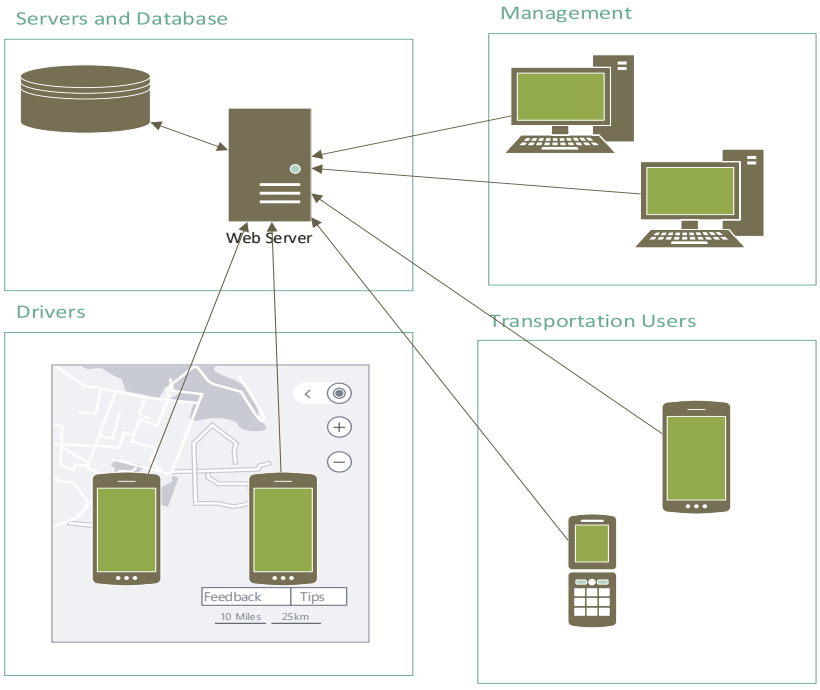
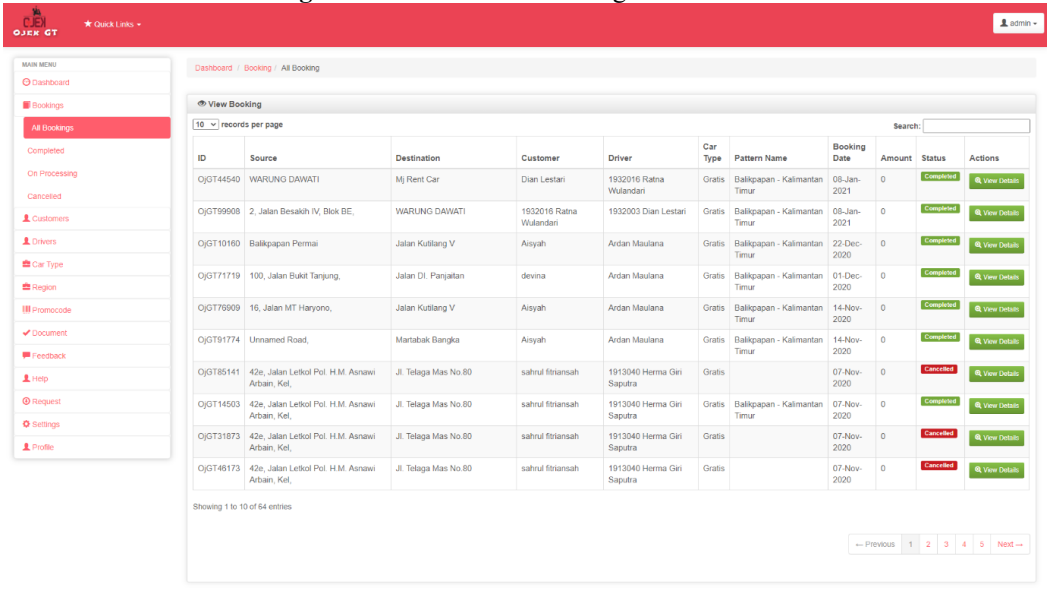


Figure 6: The web-based management in CST



The system fronted administrative users with web-based administration management which is used to manage and monitor the whole business operation. The interface of the information system is

based on a responsive design that is accessible to all computing platforms. Administrators can manage system users, monitor users, and booking transactions. Figure 5 above illustrates the booking management.

Aside from user management, administrators can manage and validate legal documents such as transport registration, driving licenses, etc. For example, in order applying to become a business partner, the drivers can complete the application via the information system using a web browser or a mobile application. The drivers are encouraged to use any platform to upload required legal documents such as the duplication of a National ID and driving license, signed consent paper, insurance documents, photos, etc. These documents can be verified by the administrator adhering to the authority's standard operational procedure to ensure legality. Almost all the approval process is conducted online, however, the administrators also could communicate with the applicants using telephony systems if any further complications are raised which are required to be settled urgently.

Both the server and client terminals are embedded with Google Application Programmable Interface (API) for the purpose of spatial data projection and collection. This is the common integration between application that connect to the internet (Sohan et al., 2017) The API used includes Maps Software Development Kit (SDK) for Android, Directions API, Distance Matrix API, Geocoding API, Geolocation API, Maps Javascript API, Places API, and Maps Static API. This system is designed according to Codeigniter framework that includes base cost, cost per kilometer, cost per minute, and maximum distance as modules. The costing modules are required to accommodate promotional discounts from time to time. The information system is also designed to collect precise spatial and non-spatial data from users with the purpose of prediction (Heaton et al., 2019) .

Figure 7: Rider and User Interfaces

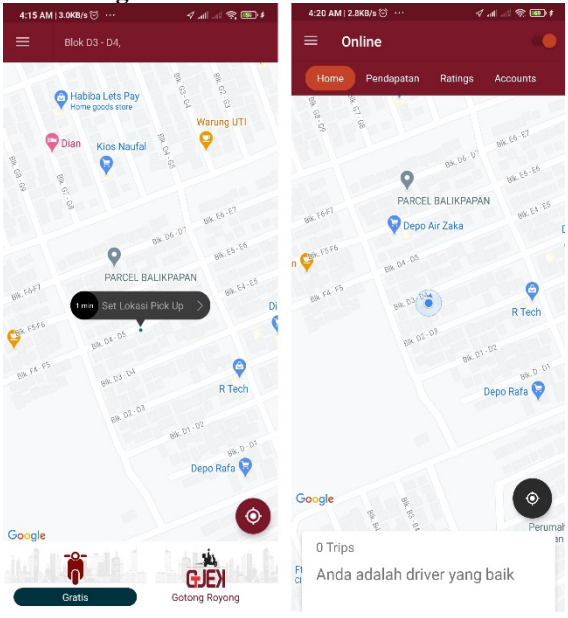
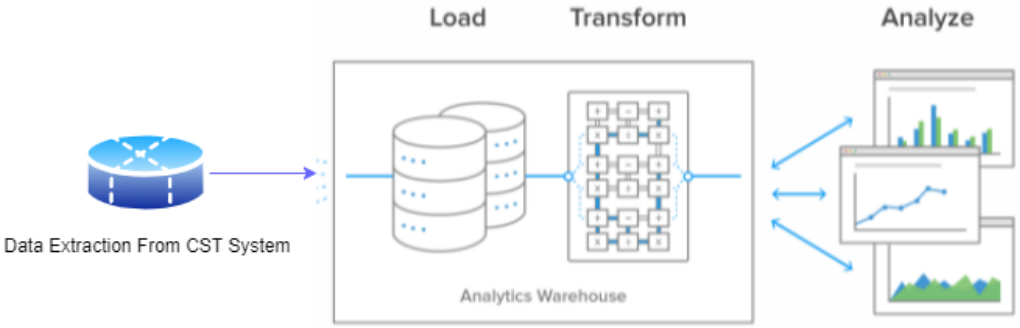


Figure 7 illustrates the interface of the Android client terminals for both drivers and users. The authentication and authorization processes are carried out on the client side in the form of a session and on the server side (web server) in the form of cookies (Anugrah & Fakhruddin, 2020). With the application, users can book rides, check riding history, apply for promotion vouchers, manage personal information, etc. The mapping interface is also designed to show road names, location directions, and road markers. Moreover, the user can also add their home and office location to complete the bookings faster. The drivers are able to select and take ride orders, check order summaries, check the rating, generate earnings reports, etc. The system also uses SMS verification to confirm customer and driver's registration into the CST. In the near future, the system will be expanded with food ordering, grocery transportation, and localized courier service.

6.1. Data Collection and Analysis

Both server and client terminals are also integrated with Firebase API that collects data directly in form of Javascript Object Notation (JSON) (Khawas & Shah, 2018) to perform Create, Read, Update, and Delete (CRUD) directly to the cloud database. Data collection is done with the consent of the users via the term of use in the registration process. The data attributes collected in the system such as personal data, user's location, vehicles data, transaction, and regional data. The data are fully extracted from the CST integrated database, loaded into a separated database in the analytics warehouse to be further transformed and analyzed when needed.

Figure 8: Data Extraction Process



The data collected are mainly used only for statistical analysis purposes. Derived data can be classified according to the measurement needs (Holcomb, 2016). These data are used to calculate business processes, generate income reports, and more importantly as a dataset for the prediction model. We use descriptive statistics to describe stored data from a user's GPS log, orders, and profile as a part of business process. As to generate income reports, we implement systematic income calculation based on the distance of the order aside from the descriptive statistic calculation that we used in the final calculation.

The revenue is generated based on the CST principle ensuring the businesses only take profit from the stakeholders and not from the society. The revenue depends very much on the partnership with the stakeholders, API expenses, and government regulations. Under most circumstances, the businesses will generate at least a 30% net profile from revenue deducting all the expenses.

7. RESULT

Our pilot study for the proposed business model is conducted where the business stakeholder is represented by the business incubator. The Ministry of Research, Innovation, and Technology of Indonesia has funded the proposed business model for three years with an amount of $34,925, along with other stakeholders. The funding is used mainly to cover ICT system development, infrastructure, and operational costs.

The business incubator is responsible for the management, operational execution, and driver recruitments. Drivers are recruited from various parts of the Balikpapan community which is mostly comprised of college students with certified driving licenses. The management is also providing operational vehicles for the drivers who did not own any. This is to ensure the participants are made up of all levels of society.

Our pilot study was carried out for merely 3 weekend days between August to December 2020 at Balikpapan City, West Kalimantan, Indonesia, where a total of 509 transportation requests has been made, and 64 completed trips which covered a total travel distance of 240.15km. Each trip is fixed at Rp. 10,000 for the driver and Rp.3,000 for the management which sums up to a total of Rp. 832.000 cost. The cost is covered by the funding from the stakeholders and third parties who participate in this business model.
Our proposed business model attracted 320 users that registered directly from the application against 39 registered drivers. However, due to the occurrence of the COVID-19 pandemic, the experiment could only be done in an extremely restricted environment and constraint period.

The study recorded trips to 42 different destinations (see Figure 9) in the city, which are represented as white dots. Among the popular destination is “Plaza Balikpapan” which is one of the well-known malls in Balikpapan. We also recorded repeated customer orders from “Jl. Telaga Mas No.80”, one of the residential areas in Balikpapan as the highest requested destination during the experiment. However, further studies are needed to find accurate data on the implication of our business model to enhance and promote local businesses.

Figure 9: The white dots indicating the 42 different destinations recorded during the pilot study

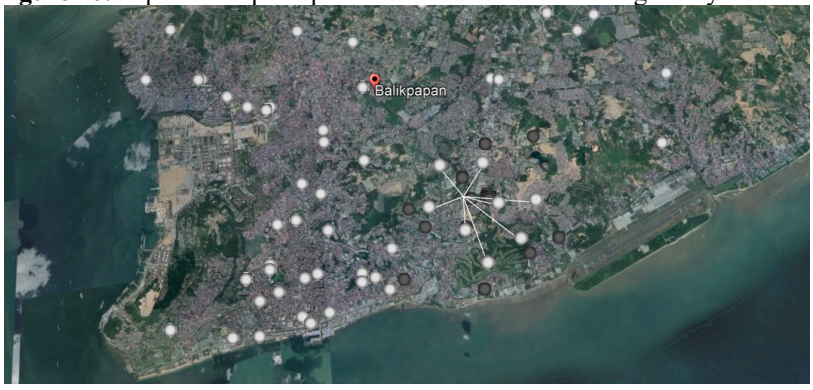
In the study, we have found out that there was 41% (or 423) of cancellations transportation requests. This happened due to restricted movement operation resulting in the hours of the experiment being limited to 08.00 AM to 05.00 PM, which was made out of operational hours. There were also 27 incomplete requests with the assumption that there were either client terminals' connection issues or functional issues.

Looking at the revenue and experimental results which generates a profit of Rp. 640.000 for the drivers and Rp. 192.000 for the management during the 3 days experiment of this model, we foresee a new opportunity to generate extra income for the society that could potentially become a fixed income for drivers and business partners. This also shows that the implementation of this model could potentially increase local income for the community in the long run and able to push all levels of the society to participate either as the consumer or the business partner.

8. IMPROVEMENT TO THE CURRENT BUSINESS MODEL

In order to minimize the operation cost, we also attempt to discover patterns that could be used to predict ideal pick-up locations according to different dates and times in a day, which is illustrated in Figure 10. We were using Google Map API to predict the proximate location of the past pick up points based on the popular request locations.

Figure 10: A predicted pickup location for drivers according to day and time



We foresee that the data are able to provide useful insight based on the users' behaviors, order locations, and preferences. The place itself can become an insight dataset that can be used to promote businesses using analytic methods (Yüksel et al., 2017). The system itself is developed by combining identified variables and discovering the relationship between those variables through a regression approach (Savanevičienė et al., 2019). This will open many possibilities to strengthen the system, improve revenue, efficiency, and minimize unnecessary work hours for drivers. With the collected data, we are planning to find patterns and relationships that can be used as a foundation for the predictive model (Benda et al., 2020) . The information could also be used for other businesses, whether as decision support, business strategies, analysis, and developments (Ngugi & Yoshida, 2016).

9. CONTRIBUTIONS TO THE SOCIETY

The implementation and the use of this business model would contribute greatly to Society 5.0 as one of its support technologies. It would also impact the culinary, education, retail, and tourism sector in particular by providing smart transportation solutions and providing an opportunity to increase revenue. As a part of the management of the business, it will also open new business sectors which focused on providing CST. The business partnership element in this model will also create job opportunities for the society whether as the drivers, sellers, or others.

10. CONCLUSIONS

Innovative smart technologies are required to support all SDGs aspects in Society 5.0. Differing from the generic smart transportation model which is only available to the middle-high class of the society, this model extends access to all levels of the society. In accordance with the smart transportation technology as one of the Society 5.0 SDGs, CST could be developed and implemented as an integrated solution to achieve the goal. The implementation of this business model proves that CST can be used as a sustainable business and provides legitimate additional income to the businesses, partners, as well as other benefits to all elements in the CST business model. However, in-depth studies are still required to show conclusive implication results compared to the other existing smart transportations and society's impacts. Due to the pandemics, we cannot collect further necessary data to strengthen our findings and hopefully this will be reported in future works. Our upcoming focus will be on a predictive analytics model to strengthen the business' promotion and market growth.

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