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Research Paper

# A Review of Business Model Transformation in Transportation Business Post Pandemic

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## Abstract

This study reviews post-pandemic business models, as demonstrated in transportation business by employing literature study method. Data obtained includes 56 articles published from 2020 to 2022 during Covid-19 pandemic that transform the business model. The results of the study indicate that there are six streams in the literature, namely (1) the impact of Covid-19 on the transportation sector, (2) the built environment for business model transportation, (3) the need for transformation of business models due to new policies, (4) changes in consumer choices and behavior, (5) supply chain management and transportation transformation, and (6) transportation business model planning. The synthesis resulted in a transportation sustainable business model transformation framework involving threat identification, company character, support, built environment, resources and capabilities, design and development, and delivery and evaluation. The transportation business needs to identify aspects of transportation services that need to be improved, adjust internal resources and capabilities, reconfigure the business, and encourage collective agreements to transform the post-pandemic transportation business model. This research contributes to the literature on transform the regular business model. It emphasizes the importance of resources and capabilities to drive business transformation internally and externally in the context of the transportation business.

**Keywords:** Transportation business; Business model; Transformation; Covid-19 pandemic

## 1. Introduction

The Covid-19 pandemic has brought an unexpected impact on the transportation business. It has significantly changed people's mobility and transportation behavior [1]–[3]. The integrity of transportation and the logistic system is severely affected [4]. The transportation business must find a way to survive during the pandemic with its fuel and passengers' rareness. Many companies, particularly aviation companies, are forced to shut their operation and park their planes [5].

These past three years have taught all companies to transform their business to adapt to the new condition [6]. To tackle all challenges, companies are trying to find the best way to survive and sustain themselves in the market. Literature records multiple strategies and approaches to handling this uncertainty and this study will record those strategies by concluding and clustering the literature in six conversations. Grouping the conversation aims to discover the pathway for a future approach in business strategy in the transportation industry. Moreover, it also can build a critical foundation for discussion of each line of inquiry [7].

With broad perspectives on the transportation business' response to a pandemic, we identify six research streams shaping the pathway of the topic we need to elaborate on in this study. The conversation starts with the impact of the Covid-

19 pandemic on the transportation business and how businesses change due to the pandemic, including changing customer or passenger preferences and supply chain. The conversation continues to suitable approaches, namely built environment and new policy. Next, scholars craft future planning and possibility due to the business model transformation stated during a pandemic. Lastly, this study will form a suggestion model for a transformational business model in the transportation sector.

The remainder of this article is structured as follows. We start the section by providing evidence and proof of changes due to pandemics. We then move to the methodology part where we explain our research method and how to gain the number of articles as a baseline for our paper. The following section will discuss six conversations that create the research stream. The last section will conclude the proposed model for a transformational business model in the transportation sector and provide future research direction aimed at developing public transport planning models that address the changing realities and challenges imposed by the pandemic crisis.

## 2. Methodology

The method employed in this research is a literature review. It is fruitful in developing theories, building evidence, and solving problems [8]. The processes conducted in this review include (1) determining questions, (2) searching the literature, (3) extracting the data, (4) making critical considerations, (5) writing the report, and (6) disseminating in a broader scope [9]. Data sources dating back to 2020. Despite criticism for the absence of the paper quality delimitation [10] and its weak performance [11], we opted for Google Scholar due to the lack of topic availability in the tighter database [12]. It is proven in the small amount of literature we found, even in Google Scholar, which database is more comprehensive than others. As a competent Big Data device, Google continuously updates its performance by improving the database based on academics' criticisms for better service [13], [14].

### 2.1. *Identification of Literatures*

Even though Google Scholar is the most convenient way in searching the literature, this study employs Google Scholar only as the first step of data collection. This research explores business model transformation in the transportation sector during the Covid-19 pandemic. Within the process, we apply Boolean search terms "pandem* AND Business Mod*" Publish or Perish. We chose Google Scholar as an existing search tool to identify all publications containing pandemic, business model transformation, Covid-19, crisis, uncertainty, and business model adaptation in the publications' title, keywords, or abstract.

After getting the data set, we read the abstracts (or full text when the classification was slightly biased) to decide whether to include or exclude the paper. Here, the principal criterion for keeping/discharging was whether the paper's main discussion includes pandemic and business model transformation in the transportation industry or system. We excluded 470 publications unrelated to the three keywords or the link was fragile. We also excluded another form of publication apart from journal articles. In this step, we exclude book chapters, magazines, or works published in popular media. **Figure 1** below explains the data collection.

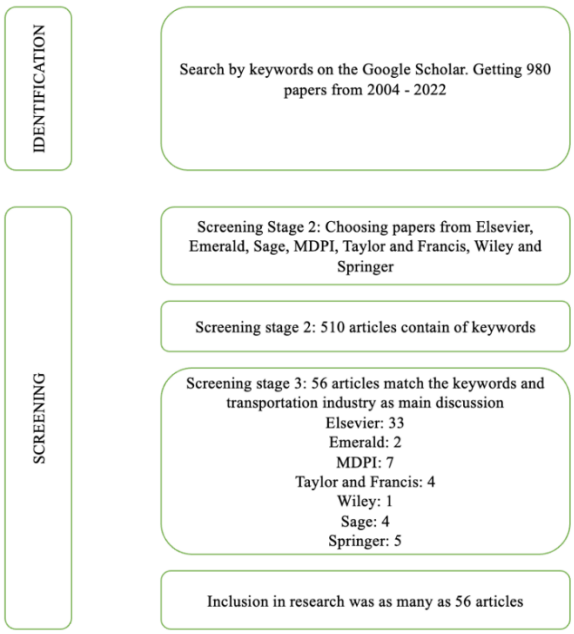


**Figure 1.** Literature identification steps

As presented in **Figure 1**, these combinations resulted in 980 articles from 2004 – 2022. The screening was then conducted by selecting only reputable indexation and publisher, Elsevier, Emerald, MDPI, Taylor and Francis, Wiley, Sage,

and Springer. This screening process resulted in 510 articles. We also ignored industry or firm-specific papers, except if the industry or firm is in the transportation field. The screening process involved keywords, covid-19 pandemic, and the transportation industry as the main discussion of the paper, and 56 articles left to be explored for this study.

### 2.2. *Data Analysis*

Firstly, we categorized the final data set of 56 articles according to the frequent discussion of the "transportation industry changing during the pandemic." The above discussion refers to the main level of analysis for this study in which researchers want to explain or say something about [15]. Publications in our data set focus on the response of the transportation industry during the pandemic (both first wave and second wave of Covid-19). Scholars discuss the internal impact and follow-up to deal with the challenge. The impact includes bankruptcy, employment cut-off, disordered supply chain, and mobility. Meanwhile, follow-up actions cover transformation, adaptation, resilience, and sustainability strategy.

To make a more meaningful classification, we included temporal dimensions in the analysis (pre, during, and post). Most papers in our data set focused on pandemic response and identified capabilities, business models, and resources to respond and adjust to the changed condition. In contrast, a smaller set of publications discussed the anticipation, future approach, or sustainable concept of transportation business towards transformative business. Following that, the data set also reveals the different effects on the transportation sector's business model due to the pandemic. Thus, we coded the literature based on discussing a changed business model in the transportation sector. Based on the analysis of the core dimensions, orientation, and conceptualization, we identified six scholarly conversations that build the foundation of this paper [7]. **Table 1** indicates those six conversations using a coding scheme. Using them as starting point, this paper will discuss each conversation in detail, elaborate on the linkage and identify potential avenues for building the proposed model.

### 2.3. *Result Description*

This paper focuses on the Covid-19 pandemic in seeing and discussing the current pandemic effect on the business model of the transportation industry. **Figure 2** illustrates the 56 articles by publication year, which started from 2020 to 2022 where Covid-19 widely spread, the waves of Covid, adaptation to Covid-19 to post Covid recovery. Article publication year and field of study shown in **Figure 3** and **Figure 4**.

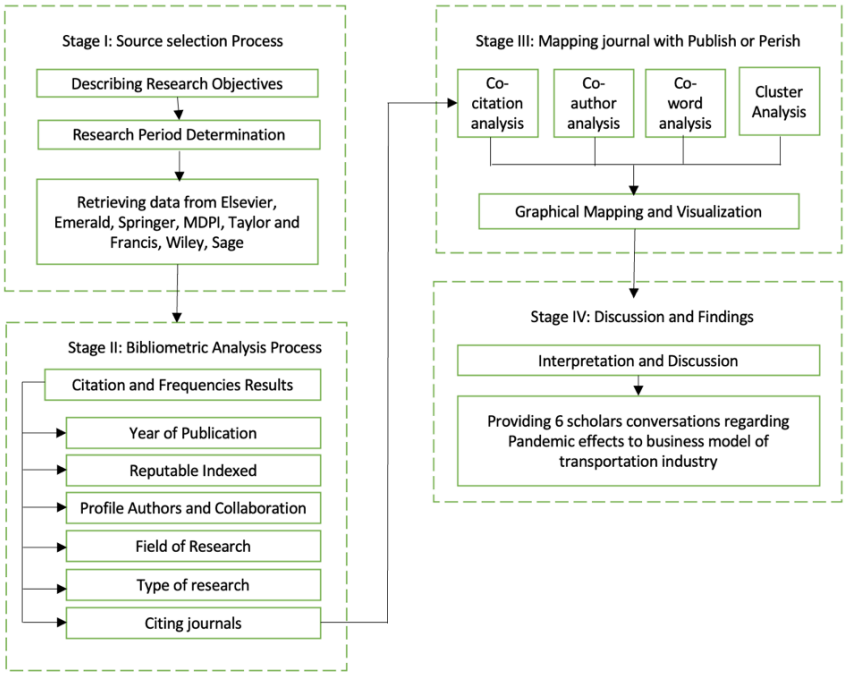


**Figure 2.** Flow chart of proposed model

**Table 1.** Sources data

| Document Type | Frequency (n) | Percent (%) |
|---|---|---|
| Research Article | 48 | 86% |
| Review Article | 8 | 14% |

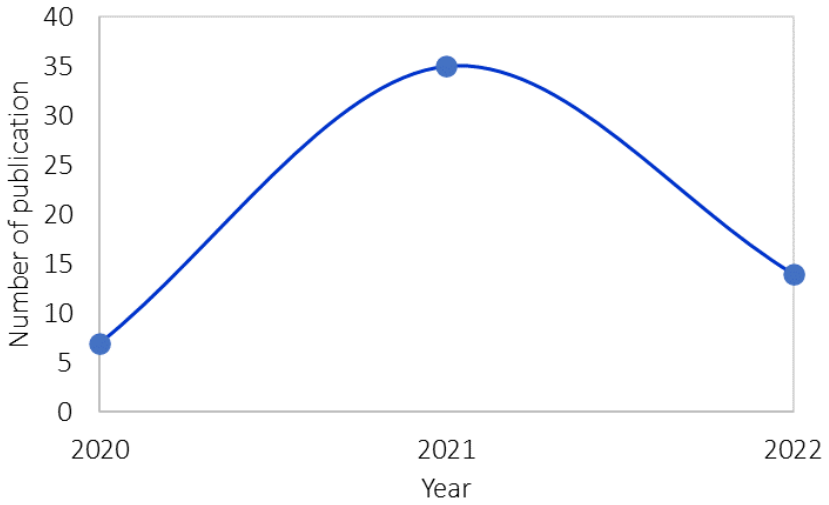


**Figure 3.** Article publication year

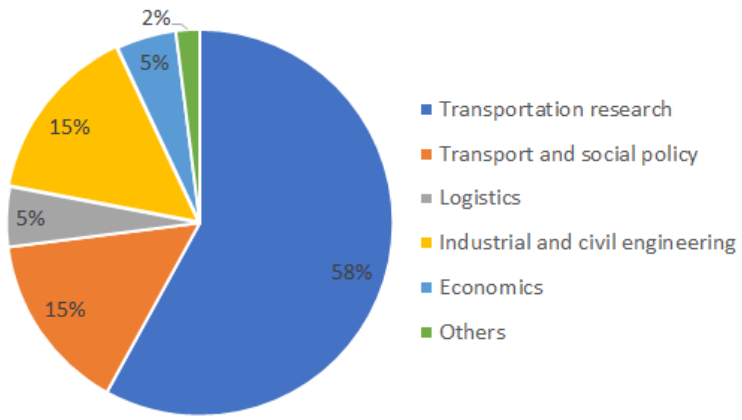


**Figure 4.** Field of study

### *2.4. Research Orientation*

Based on the dimensions and categorization of the existing literature, we arrived at six conversations. Each is described in turn.

#### *2.4.1. Conversation (1): Covid-19 Impact on the Transportation Sector*

Eleven papers in the data set discuss the direct effect of Covid-19 on transportation businesses and planning in saving their business during and post-pandemic. The discussion starts with the impact of Covid-19 on the transportation industry's workforce. Stelmachova et al. [16] pinned out how enterprises limit their HR recruitment during pandemics while increasing the number of job seekers. Mack et al. [17] added that unemployment increases due to the inability of the workforce to keep up with teleworking during a pandemic.

On the other hand, Budd et al. [18] explain how all kinds of business models in the airline from full-service carriers, low-cost carriers, charter, and regional airlines are affected by their flight operation, fleet, labor, network, and capacity. This finding is strengthened by Deveci et al. [19] that elaborated on the impact of this pandemic on the airfreight sector which includes flight restriction, repatriation flight, fleet reduction, network changes, and workforce. In the railway business, Tardivo et al. [20] emphasized how customer behavior and environment changed due to this pandemic and introduced the 5Rs (Resilience,

Return, Reimagination, Reform and Research) strategy to bounce back railway business performance after the Covid-19 era.

While in car transport, the reduction of car usage decreased to 80% during the pandemic [21]. Aparicio et al [22] reported an interesting finding that decreasing passenger in public transportation is greater in cities and high-income areas rather than a zone with lower income. It appears that there is a relationship between the demand for using public transportation and the average income. In public transport itself, an emerging relief plan is set up to assist its system, namely dedicated network, funding, improving non-motorized transport infrastructure, and economic stimulus [23]. Following that, transportation arrangements during a pandemic both in its route and its restriction are proven to effectively reduce virus spreading and provide comprehensive consideration of epicenter location [24].

The impacts of the Covid-19 pandemic on transportation business are not only at the micro level, Cui et al [25] elaborate on the macro implication from GDP decreasing, economic recession to exogenous shock while Tian et al [26] looked up the emission rate during pandemic which experiences a decreasing trend. The drop in emission rate is the only good news about the impact of the Covid-19 pandemic so far.

Above scholars have elicited the impact of the Covid-19 pandemic on transportation business from airfreight to public transportation on road. To deal with these impacts, transportation enterprises must transform their business model to adapt to new conditions and changing preferences. Several essential elements need to be counted in a transformation business model such as resiliency, flexible fare and route arrangement, and adaptation to changing environment. This last element delivers the second scholarly conversation on this issue.

#### 2.4.2. *Conversation (2): Built Environment for Business Model Transformation*

The effect of the built environment on changing the business model to a transformative one is discussed next. Since the Covid-19 pandemic caused an environmental shock to everyone worldwide without exception, literature divided into two approaches to handling it. Amankwah [27] provided pre, during, and post-pandemic responses to Covid-19 especially to the airline business. The author developed four quadrants of airline responses to Covid-19 that cover internally generated short-term responses, externally imposes short-term responses, internally generated long-term responses, and externally imposes long-term responses. Other researchers summarised a significant shift in transformation sectors due to its built environment since the Covid-19 era. They argued that the changing travel behavior, sharing economy, transportation technology, and activities will reform a new business model to support more multimodality and accessibility for transportation business [28], [29].

This Covid-19 crisis changes the built environment in terms of transforming it to accommodate a more modern transportation system that requires high exploitation of technology and sharing economy [29]. The changing tests market capabilities, route network, and customer relationship [27]. On the other hand, the built environment is considered to support multimodality and accessibility in modern transportation systems as an effect of disruption [28].

Speaking of its impact on a business model in the transportation sector, we can conclude that the change creates a built environment that appeared due to a specific event and adaptation to that event. The built environment may change the business model in terms of external and environmental factors that lead the business to different operations from its regular. The factors are unavoidable and yet unpredictable. Hence, the business model has to be a changeable and more critical one, transportation sector cannot only depend on their operation and source of income in one single door. It means diversification and differentiation strategies are substantial in the transportation business.

#### 2.4.3. *Conversation (3): New Policy increases the need for business model transformation*

Government or organizational policy is tested during a pandemic mainly due to unexpected events requiring a fast and direct response. Lag usually appears to match policy and its implementation, making it challenging to implement new policies tackling hardship during a pandemic [30]. However, the crisis can be seen as an imperative and opportunity for transportation reborn [31]. Several strategic

approaches can be taken such as creating a sustainable urban transportation system, increasing flexibility, reliability, and resilience of traffic governance [32], creating a transport reform advocacy group [31], and reducing the time-consuming of implementing new policy [30].

New policies are stated and some have been implemented to respond to the Covid-19 pandemic. New policies include regenerating internal enterprises such as cut-off employee or cost efficiency and more generous government policy such as tax reduction or free tax [25], [33]. On the other hand, scholars also discuss the effect of other countries' entry restrictions to another country [32] and changing travel behavior and its effect on new policy creation [33].

Based on the above conversations, this paper can state that crisis transforms the transportation sector's business model by including policy as an aggregator, a key partner in building a more complex yet complete transportation ecosystem, and developing during and post-pandemic transportation system. The policy made by its organization or high-end managers and policy made by the government is essential to help and support the resilience and sustainability of the transportation sector.

#### 2.4.4. *Conversation (4): Changing in Customer Preferences and Behavior*

Covid-19 pandemic is undeniably changing customer preferences in their transportation choice from using motorized transport to riding a bicycle, the way they travel to how long and how often they travel [34]–[37]. These all-changing preferences are unlimited to race, background, and education and reflect on the built environment in imposing responses [34]. Passengers or travelers pay careful attention to their perception of risk, their tendency to take precautious when they leave home to socio-economic factors in deciding what transport modes will they use or whether they want to leave home or stay inside [38]. Literature also records that preference for using public transportation during pandemics differs among people with high and lower incomes. This finding is similar in all transport modes from airfreight, public transportation, and ride-sharing to micromobility [34]–[36], [38]. Therefore, transportation modes need to adapt in all ways from setting up fair travel fares that accommodate transportation management and its employees [35], [39]. Additionally, Monmousseau et al. [36] suggested a feedback loop for passengers and airlines to maintain customer relations and loyalty.

Taking account of customer changing behavior after Covid-19 is not the only concern. Paying in-depth attention to customer value is essential since customers depend on their value in choosing and doing something in their life, such as choosing a safe transportation mode. Timokhina et al [40] underlined the customer value of car owners to include them as potential public transportation users. Authors stated the values of public transportation that lead car owners to shift from driving their car to being a passenger of public transportation, such as safety, conformity, hedonism, stimulation, versatility, and others.

Changing customer preference and behavior results in a changing business model to a transformative one. Several points that need to be taken into account are shifting in fare revenue, subsidy support, and customer relation that led to a new version of the business model in the transportation industry. Apart from that, the type of transportation choices will vary in the future. Emerging types such as ride-sourcing, e-scooter, e-bicycle, waterways, and railways need to be optimized more to give travelers more choices when they are not comfortable with their regular choice [28].

#### 2.4.5. *Conversation (5): Supply Chain Management and Transportation Transformation*

Apart from facilitating people in their movement, transportation modes are employed as logistics distribution, hence Logistics and Supply Chain Management (LSCM) is essential and need to be more active in pandemic with an integrated approach, budget allocation, and capability to adapt [41], [42]. To discover new opportunities and adapting to service offers, transportation business must change their supply chain strategy. For the cargo ship, it is advised to change their storage period to fit customers' needs and decrease cargo turnover [43].

However, most literature focus on the post-pandemic management system in reaction to uncertainty. Hence, business model transformation for the transportation sector has to develop a pre-crisis management system to encounter any unexpected situation.

#### 2.4.6. *Conversation (6): Future Planning for Business Model for Transportation Business*

Looking at the changing business model during the pandemic, the transportation business is expected to transform its business model. Previous literature stated two different plans: tactical and operational planning [44]. Tactical planning covers activities in reducing any loss and increasing efficiency in business. Meanwhile, operational planning is about shifting regular operations to more adaptive ones such as simplifying the booking system or skipping certain stations when overcrowds.

Moreover, the business model for the transportation sector in the future is required to underline the avoid-shift-improve framework to set their business model plan. This framework helps in presenting practical implications. Firstly, avoid strategy delivers an approach to avoid the virus spreading such as protection action, predicting any changing behavior, and reducing the risk of exposure. Secondly, shift strategy focuses on changing systems and procedures to adapt to new environments. Lastly, an improved strategy concentrates on optimizing sustainable transportation infrastructure and design [45]. This sustainability scheme is applied in all transportation modes to benefit people and the environment for a long-term impact of transportation multimodality and accessibility [28]. Furthermore, future planning also covers improving service quality. Tumsekcali et al [46] suggest an advanced model of service quality called P-SERVQUAL 4.0 as a development of SERVQUAL, which include tangibles, responsiveness, empathy, assurance, reliability, digital technology, and pandemic in the model.

Future planning for a transformational business model in the transportation sector is not limited to one modal only. Truong [47] discussed how airfreight cannot reach its typical performance in a short time even though the pandemic is over. Gonzales et al. [48] focused on road transport transformation by providing infrastructure, increasing investment, and maintaining the country's situation. Pineiro et al [49] pointed out their study in maritime transportation where they underlined three future planning for the maritime sector, namely human element in maritime safety, digitalization, and socio-economic. Lastly Corazza and Musso, [50] pinned future planning in urban transport using ARDUOUD (Adjustment, Redesign, Domesticity, Unsharing, Organisation, Unsustainability, Standardisation) approach. Future planning for urban mobility stands on the policy established by creating resilience in urban mobility by applying the ARDUOUD strategy. Meanwhile, Serdor et al [51] added that resilience needed by the transportation sector is a combination of robustness, reliability, vulnerability, risk management, survivability, and flexibility.

Literature has settled various strategies for future business models in all transportation modals from airfreight, road transportation, railway, urban transportation, and micro-mobility to ride-sharing. Hence, from the literature, we can conclude that the transformation business model should emphasize points such as tactical and operational planning, adaptive and flexible system, service quality, and sustainable transportation infrastructure and design. The fittest business model to adapt and cover all elements mentioned above is an open business model which focuses on filling customer needs and has a sustainability strategy [52].

## 3. Results and Discussion

Above conversations craft strategies based on literature both empirical and systematic study which conically lead to a strategy to sustain in the market and embrace change [53]. This study states that strategy is a transformational business model. Companies rely on a business model to comprehensively develop their strategies during stable times. They need practical guidelines to capture, visualize, comprehend, and communicate business logic [54]. A business model performs those tasks. Thus, the organization can create, provide, and catch the values efficiently and effectively [55]. A business model represents the company's main logic and strategic choices in creating and capturing value in a value framework [56].

Even so, developing a business model is not an easy thing. The business model is specific and sometimes lacks pre-existing examples for innovative products. Conflicts with available assets and mindset about what it is like to run the right business can be an obstacle for a company in producing an optimal business model.

Experimentation, effectuation, and leadership in organizational change play an important role in eliminating these obstacles [57].

In addition, business models need to adapt to changing business environments. Business model adaptation prevents companies from surviving in the competition. Companies that perceive threats and have a strategic orientation to develop the market tends to change their business model compared to companies that only perceive opportunities and take defensive strategies to maintain the existing market [58]. In this case, the concept of a business model transformation appears [59].

Moreover, the demands of the current business ecosystem have changed from just a linear business to a circular one. In a linear economy, companies formulate a business model with a take-make-waste logic, while in a circular economy, reuse, repair, and restorative principles become essential [60]. Circular business models need to consider not only the principles of a circular economy but also the success factors and various inputs into the model [61].

While the circular business model is oriented toward economic integration with the environment, the social business model is oriented towards economic integration with social benefits [62]. Both, however, only touch on the two pillars of sustainability. When the issue of sustainability is brought to the fore, the business model also needs to consider all pillars of sustainability, including economic, social, and environmental. A sustainable business model is a business model that creates a competitive advantage through superior customer value while contributing to the sustainable development of the company and society [63]. This business model requires a value network with a new purpose, design, and governance [64]. Joyce and Paquin [65] developed a three-layer business model canvas, a direct extension of Osterwalder's and Pigneur's [66] linear business model canvas. A business model canvas is a tool to visualize a business model [56]. Two new layers are added to it, the environmental and social layers. A company needs to consider these three aspects in building a sustainable-oriented business model. Some studies adopted this model canvas to build a model that provides a more positive impact on the social and natural environment [56], [67]–[69].

The pandemic is bringing a new dimension to business models that were not considered before. Reeves et al [70] stated that strategies are essential in both usual and threatening times and that the strategies applied regularly are different from those in a crisis. However, current business model transformation frameworks are made under normal circumstances. Thus, strategies for a threatening context are required.

The experimental nature, the need to adapt, and the demands for sustainability and business behavior in the crisis era encourage a company's business model to become more complex and change over time to time. Business models are also industry-specific. A transportation business model needs to incorporate all these requirements to be able to not only survive but thrive in a changing business environment. Here, we need to look at the empirical studies on how transportation companies adapt to the Covid-19 pandemic. Some studies reveal various factors ensuring their survival during the pandemic [71].

Considering the various theoretical and empirical literature and their relevance to the transportation business during the pandemic, we find out that the transportation business model can be reconstructed following six steps, as shown in **Figure 5**.

Research shows that an organization is more likely to change its business model when faced with threats, especially unexpected ones such as the Covid-19 pandemic than to identify opportunities [58]. Although there have also been studies that develop business models in situations of seizing opportunities [72], sensitivity to threats is more likely to lead to business model changes. The threat priority is in line with prospect theory which states that managers are more likely to take risky actions if they are under threat rather than in more favorable conditions [73].

Companies should have a reliable and trustworthy information source enabling knowledgeable decision-making. There must be an early warning system to obtain external information as soon as possible. This step also contains the potential impacts of poor information from the system and the compromised companies

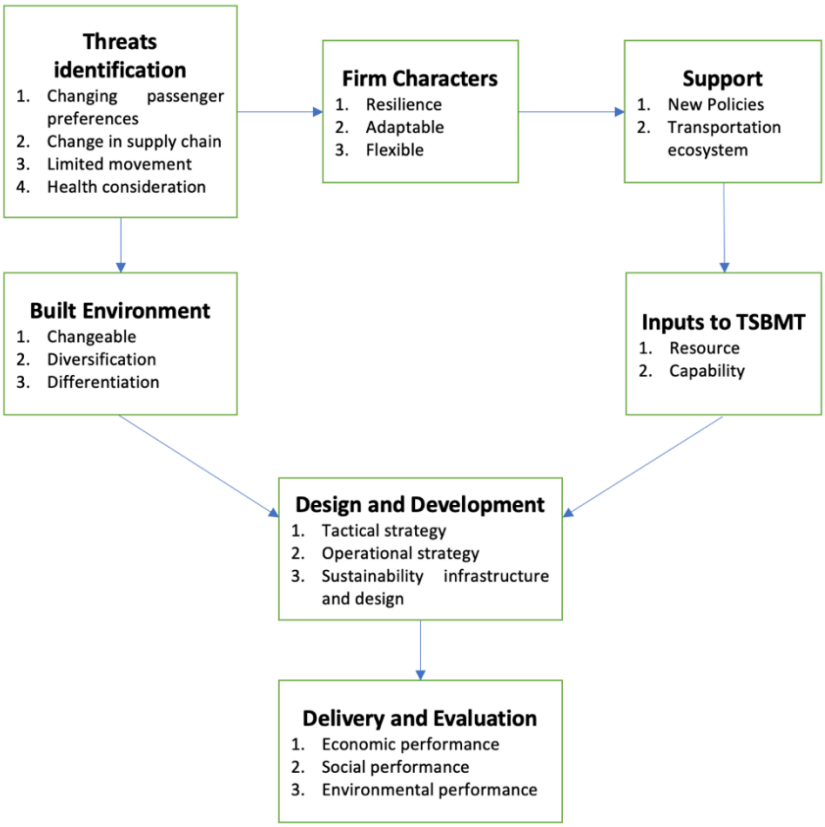


**Figure 5.** Transportation sustainable business model transformation (TSBMT)

assets. Thus, they can take either reinforcing or fleeing measures. The threat updates the critical condition. It determines the organization's survival in an externally-sourced crisis case. It also defines the crisis' impact on the company's public image when the threat comes internally. Threats should be divided into aspects of triple-bottom lines: business threats, social threats, and environmental threats.

In the TSBMT model (**Figure 5**), the legitimacy statement is a strong character. Research points out legitimacy's importance in any BMT initiative [63]. It is relevant in the critical situation as the considerations are generally primary and functional, such as the closest vehicle to the emergency site. The more specific component describes the moral, pragmatic, and cognitive legitimacy. A legitimacy statement is a detailed description of a possible crisis like a pandemic. In this sense, the objective of a business model is to grow the transportation business under threats. Pragmatic legitimacy relates to efforts to encourage economic gain, while moral legitimacy relates to belief-based obligations for the good of humans. Cognitive legitimacy is related to rationalization with a cultural basis [63].

After legitimacy for the change is gained, the process moves to support needed to survive and sustain the industry. In this case, the existence of a transportation ecosystem is crucial. By having an ecosystem, the transportation business gains various supports, especially having government setting supporting policies to grow its business.

The next component in the model is input to TSBMT. These inputs relate to the firm's resources and capabilities, as stated by the resource-based view [74]. The resources are staff, fleets, and capital, while capability includes market intelligence, entrepreneurship, marketing communication, resource management, and incentive structure [61]. A threat could affect the number of staff in a transportation company [18]. Transportation company needs to consider the operational staff like drivers, pilots, and flight attendants. It also reviews the supporting staff in the office, how many additions or subtraction are required, how many trained staff is, and what their competence is. Besides, it also sees if they can transfer to a partner institution as helping laborers. If they are laid off, the block needs to calculate how much money is required to support them. The human resource in TSBMT also features

human resources, especially the impact of the threat on them.

Another resource vital to the transportation sector is fleets. Vehicles reconfiguration is inevitable when a transportation sector faces a threat [18]. Fleet consideration formulates the configuration steps companies take and includes the number of active fleets, the needed support, and the route closed or changed. The particular route might need additional fleets. Besides, they also allocate the fleet for new needs such as evacuation or charter by particular institutions, including the government.

Financial capital is crucial in a company's capacity during a crisis. It covers the profit aspect (gain) and loss (pain) as well as income and cost. A study reveals that transportation companies with huge debts have a bigger chance of failing to adapt to the pandemic [75]. Included in the capital is gain from partnership, loan, and operating profit and loss.

One of the critical outcomes of threat identification is the relationship between the transportation companies and the stakeholders. These stakeholders include elements in the sustainable value network such as society, natural environment, customer, government, alliance partner, and supplier [64]. Business alliance boosts transportation business survival during the pandemic [71]. Each stakeholder has value forms linking the stakeholder with the focal firm. A healthy value link provides external resources and capabilities needed to support the internal resources and capabilities of the focal firm. In contrast, broken link poses threats identified by the initial process in the TSBMT framework and initiating legitimacy statement.

Finally, after the firm has enough knowledge about the threat, has legitimacy and commitment to change, and has the resource and capability to transform, externally and internally, the firm could embark on the design and development stage. The design steps must include ReSOLVE (regenerate, share, loop, optimize, virtualize, and exchange) framework elements [76]. Regenerate means actions aimed at restoring ecosystems, for example, by replacing fossil fuels with electricity. Share means extending the product's life span by sharing it with several users, for example, using a used vehicle or selling the vehicle to other transportation services. Optimize is oriented towards increasing transportation efficiency by using ride-sharing software. Loop aims at developing recycling opportunities while virtualize means increasing product dematerialization. The exchange aims to replace existing activities and technologies with more innovative and efficient materials or technologies [77].

After knowing which aspects of the transportation service need to be improved, internal adjustments, business reconfiguration, and collective agreements must be taken to bring to the implementation stage and, finally, evaluation. The evaluation must be directed toward economic, social, and environmental performance. Various shortcomings that arise from the evaluation can be corrected or lead to feedback leading to the identification of threats in the next TSBMT cycle. Massa et al. [78] argued that a business model is a broadening concept strategy.

## 4. Conclusion

This article makes the following contributions to the field of business model research. It presented state-of-the-art empirical research related to the transformation of the transportation business model after the Covid-19 pandemic. The evidence regarding components of threat identification, company character, support, built environment, resources and capabilities, design and development, and delivery and evaluation. By evaluating the results of the latest relevant research, this article provides a roadmap for undergoing the process of transforming business models and developing the resilience of the transportation business after experiencing disruption from crisis events such as pandemics. It expands existing business model transformation literature, focusing mainly on transportation business and pandemics. Furthermore, the article has evaluated the suitability of business model theory and its particular orientation on transformation.

Concerning management practice, the article encourages applying transportation sustainable business model transformation (TSBMT) to transportation business to adapt to the pandemic or similar prolonged crises. The framework may be a valuable source for practitioners as well. Concerning the model, the possibilities of combining TSBMT with other frameworks with a

related business sector may be performed. Such a combination can be applied in the context of transportation business supply chain or new technological-based transportation services such as ride-sharing application business or automatic vehicle services. The combination is certainly worth further explorations with rigorous analysis in future research.

## Author's Declaration

### Authors' contributions and responsibilities

The authors made substantial contributions to the conception and design of the study. The authors took responsibility for data analysis, interpretation and discussion of results. The authors read and approved the final manuscript.


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### Availability of data and materials

All data are available from the authors.

### Competing interests

The authors declare no competing interest.

### Additional information

No additional information from the authors.

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