BUILDING A SUSTAINABLE FUTURE BY DEVELOPING THE CONCEPT OF DOUBLE DIAMOND IN TRIPLE DIAMOND, A NEW CONCEPT IN CREATING A NUDGE TOWARDS PRO-ELECTRIFICATION BEHAVIOR IN URBAN FREIGHT TRANSPORT

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Abstract

In the present economic setting, road freight transportation accounts for 77% of the total products moved by land inside the European Union. However, it is undeniable that, from a certain perspective Historically, vehicles were detrimental to the environment. The freight transport sector accounts for one-fourth of greenhouse gas emissions from road transport and roughly 6% of overall greenhouse gas emissions in Europe. Consequently, the vehicle electrical industry is poised for growth in Europe in the future.

Electrification is a growing trend driven by the necessity to reduce carbon emissions, enhance air quality, and ensure compliance. Regulations governing urban emissions are stringent.

These policies are contextualized within the European Union's target of achieving "a reduction of at least 55% of greenhouse gas emissions by 2030 and climate neutrality by 2050," as outlined in the European Green Deal.

The Truck E-mobility concept in urban agglomerations pertains to the use of electric vehicles, both high and small tonnage, for freight transportation in urban settings. This movement is driven by the necessity to mitigate pollution, enhance logistical efficiency, and comply with stringent regulations in densely populated urban areas.

To promote sustainable development, we propose the saddle transformer within the framework of a novel Diamond idea based on the Double Diamond model. The first offers a strategic design framework applicable to innovation processes and issue-solving. The

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Triple Diamond is a novel idea that effectively provides a strategic framework for implementing solutions in problem resolution.

Keywords: Sustainable Transport, Green Economy, Truck E-mobility, Double Diamond, Triple Diamond, Nudging

JEL Classification: Q50, Q55, Q56

1. Introduction

The concept of a green economy, first introduced in 1989 in a report for the United Kingdom government by a group of environmental economists titled "Blueprint for a Green Economy" [1], fundamentally underpinned the implementation of an inclusive green savings strategy at the United Nations Conference on Sustainable Development in 2012 (Rio+20) [2].

The definition provided by UNEP (2011) [3] is one of the most recognized internationally and widely utilized, stating that a "Green Economy" is an economy that enhances the welfare of populations and promotes social equity, while simultaneously significantly reducing environmental risks and constraints. It is an economy characterized by minimal carbon emissions, resource efficiency, and social inclusivity.

The notion of a green economy has garnered substantial international attention in recent years, both as a mechanism for resolving the financial crisis of 2008 and as one of the two themes for the United Nations Conference on Sustainable Development since 2012 (Rio+20). Consequently, this contributed to the growth of the concept through expanding literature and rising international practices. It is essential to acknowledge that when the notion was initially embraced as a theme for Rio+20, there was also ambiguity in EAEC. What is the link between a green economy and internationally accepted objectives, such as sustainable development and poverty eradication, as well as the lack of knowledge in the EAEC? What are the possible problems, risks, costs, and rewards associated with the adoption of a green savings policy?

The primary aim of the EAEC The envisioned economy is one that fosters a sustainable future characterized by low carbon dioxide (CO2) emissions, achieved through a transition to ecological production and consumption models that prioritize resource efficiency. This work may be accomplished through the utilization of renewable energy, the adoption of energy-efficient technology, and the implementation of circular economic models that prioritize waste reduction and resource efficiency.

The shift to a green economy also has enormous hurdles, including the necessity for substantial investment in technology and infrastructure, as well as the need to balance economic, social, and environmental factors.

Road freight transportation accounts for 77% of the total products moved by land inside the European Union and produces a commercial surplus of billions of euros yearly for the EU. They are a significant and integral element of the economy. The freight transport sector accounts for one-quarter of greenhouse gas emissions from road transport and roughly 6% of overall greenhouse gas emissions in Europe. Consequently, the vehicle electrical market will expand in Europe in the future.

Considering the present setting in which commodities are predominantly carried via road, a mode responsible for 72% of total CO2 emissions from the transport sector, global efforts are being made to promote electric freight transport. These policies are contextualized within the EU's target of lowering greenhouse gas emissions by at least 55% by 2030 and achieving climate neutrality by 2050, as outlined in the "European Green Deal." Governments, corporations, and individuals must collaborate to address these challenges and expedite the transition to electrified urban freight transport.

Electric mobility for trucks (truck e-mobility) plays a vital part in the transition to more sustainable and environmentally sound transportation in urban environments.

Truck E-mobility [4] in urban agglomerations pertains to the utilization of electric vehicles, both big and small tonnage, for freight transportation inside urban environments. This movement is propelled by the necessity to diminish pollution, enhance logistical efficiency, and comply with stringent regulations in densely populated urban areas.

What is the significance of implementing electrification of vehicles in urban areas?

• Air pollution reduction: electric trucks eliminate greenhouse gas emissions (CO_2) and atmospheric pollutants (NOx, fine particulate matter).

• Strict regulations about emissions: several European cities, including London and Paris, are instituting Low Emission Zones (LEZ), which restrict diesel cars, while also mandating a shift to zero-emission vehicles.

• Reduction of urban noise: electric trucks are considerably quieter than their diesel counterparts. What factors help to the reduction of pollutant phonics?

• Delivery request Rapid and sustainable: rise in e-commerce and anticipations client for delivery. The advent of rapid transit has resulted in a heightened influx of automobiles in urban areas; thus, electric trucks are a viable answer for more sustainable transportation.

Electric Mobility for Trucks Urban challenges:

• Autonomy of batteries: electric trucks and vehicles possess a limited range, making them more ideal for short-distance transportation or local delivery rather than intercity transit.

• Charging infrastructure: the scarcity of charging outlets in urban areas and logistics warehouses is a significant hurdle.

Initial expenditures for electric trucks are greater than those for diesel vehicles, however their operational costs are comparatively lower.

• Pregnancy is advantageous: batteries are bulky and heavy, reducing vehicle load capacity.

Integration with electric networks: the rising number of electric cars may need increased energy requirements for networks, which must be equipped to manage rapid loading well.

Emerging solutions and trends in Truck E-mobility:

• Dedicated charging infrastructure: ultra-fast charging stations for trucks, strategically located in urban areas and near logistics depots; logistics hubs equipped with renewable energy sources (e.g., solar panels) for charging purposes.

• Advanced battery technology: high-density batteries provide more power capacity, potentially increasing autonomy and reducing charging times.

• Pilot projects in major cities: firms such as Amazon, DHL, and IKEA are testing electric truck fleets for urban delivery, while manufacturers like Tesla Semi, Volvo FL Electric, and Mercedes eActros are introducing electric trucks for urban transportation.

• Innovations in logistics: last-mile deliveries facilitated by drones or tiny electric vehicles (cargo bikes) and the exchange of data between enterprises for route optimization and a decrease in the number of cars on the streets.

• Governmental subsidies and policies: governments provide incentives. Funding for the procurement of vehicle electrical systems and the construction of charging infrastructure.

Examples of effective practices with the adoption of Truck E-mobility:

• London: Ultra-Low Emission Zones (ULEZ) [5] promote the transition to electric cars for cargo delivery and electric truck fleets utilized by maritime merchants.

• Amsterdam: "Zero Emission Zones" Plan [6] (until 2025) which restricts entry for diesel cars in some areas of the city and establishes Micro-Logistics Hubs for efficient deliveries using electric vehicles.

• Copenhagen: Utilize electric cars for all government supplies and increase the network of charging stations.

Long-term benefits of Truck E-mobility in urban areas:

• Operational cost reduction: Electric energy expenses are lower than those for fossil fuels, and maintenance is very straightforward.

• Sustainability and positive image: Companies that employ electric vehicles may enhance their reputation, appealing to environmentally conscious clients.

• Growth Efficiency: Electric cars may be combined with autonomous driving technology, significantly enhancing logistics efficiency.

Truck E-mobility is essential for addressing contemporary urban difficulties; yet, its success relies on collaboration among manufacturers, governments, and logistics operators. Infrastructure adaptation and cost-reduction technologies will expedite the transition to electric transportation in densely populated cities.

Truck E-mobility is a crucial aspect of the transition towards sustainable development and a sustainable future, linked with global aims to combat climate change and mitigate the negative environmental impacts of transportation. Electric mobility in the vehicle sector provides answers for many economic, social, and environmental concerns, significantly contributing to progress. Sustainable electric mobility for trucks (truck e-mobility) plays a vital part in the transition to more sustainable and ecological transportation.

Consequently, while sustainability and sustainable development are interconnected ideas, they possess unique meanings.

Sustainability denotes the capacity of a system or process to be sustained at a specific level across time. In a background setting, it signifies the necessity of generating current meetings without jeopardizing future capacity production while fulfilling one's own requirements. Sustainable development is a comprehensive term that encompasses not only environmental sustainability but also economic and social sustainability.

The most recognized definition of sustainable development is provided by the World Commission on Environment and Development (WCED) in the Brundtland Report: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." [7]

2. Nudging

Nudging is a concept from behavioral sciences, economics, and psychology that focuses on subtly influencing individuals' actions without constraining their choices or significantly altering economic incentives. It is a method to influence behavior towards a desired outcome by modifying underlying decision-making processes.

The notion of nudge encompasses several strategies employed to assist individuals in making superior decisions without imposing certain outcomes on anybody.

Nudging was introduced in 2008 by Richard Thaler and Cass Sunstein and is described as "any aspect of the choice architecture that modifies individuals' behavior in a predictable manner, without prohibiting any options or significantly altering economic incentives." [8]

For an intervention to qualify as a simple motivation, it must be easily avoidable and inexpensive.

The word was popularized by economists Richard Thaler and Cass Sunstein in their book "Nudge: Improving Decisions About Health, Wealth, and Happiness." [9] In the context of time, "architecture of choice," as defined, pertains to "the environment" in which humans make decisions. [10]

The strategist begins with the premise that sustainable development offers a conceptual framework that, when embraced by citizens, will facilitate the establishment of a fair enterprise characterized by balance and solidarity, enabling adaptation to changes induced by global, regional, and national challenges, including demographic decline.

Skepticism and criticism are common reactions in the rest of the world about "nudges," due to the fact that their objective is to alter an individual's behavior. Some authors regard nudging as both protective and patronizing.

Attributes of nudging:

• Subtlety: Does not enforce rules or prohibitions, but facilitates the decision-making process to promote outcomes that are more beneficial for the person or society.

• Freedom of choice: Does not restrict available options.

• Influence of context: Decisions are affected by the mode in which options are presented. Advantages: Assists individuals in making judgments that may be more advantageous or prudent in the long run; Costs are minimal compared to established laws.

Criticism may be perceived as manipulative, particularly if goals lack transparency; its effectiveness is contingent upon cultural context and the manner of application.

Nudging is a strategy of persuasion that maintains individual individuality while subtly encouraging desirable behaviors, particularly in the context of enhancing urban freight transit in Romania alongside European Union obligations.

Punctuality in the context of assimilating electrification in urban freight transport arises when involved parties encounter challenging and unique scenarios that complicate rational decision-making. In such instances, ISI proposes a well-structured nudge or incentive:

Instances of nudging in the integration of Truck E-mobility inside urban freight transport in Romania (source, author):

• Online environment: Brand awareness through viral video content produced by an influencer on platforms such as Facebook and Instagram, focusing on user engagement; Social messaging: Collantare Trucking's electric vehicles promoting "pro-electrification/pro-neutrality" messages regarding climate and CO2 reduction, aimed at raising awareness among all interested parties.

3. Double diamond

The Double Diamond is a design process concept popularized by the British Design Council in 2005. [11] The technique was modified following the divergence-convergence model introduced in 1996 by the Hungarian - American linguist Béla H. Bánáthy. [12] [13]. It is prominent in user-centric design because it gives a clear direction for an approach confronts complexity in a systematic and innovative manner.

The Double Diamond framework encompasses two diamonds that integrate four design phases, showing a comprehensive overview of the design process.

1. Discoverr • Purpose: Comprehending context, identifying user needs, and recognizing difficulties. • Methods: User interviews; Observation; Secondary research (data analysis, existing studies) Outcome: A definitive understanding of the actual situation and a compilation of insights.

2. Define • Purpose: Concentrate on the primary issue to be addressed, encapsulating the insights gathered during the Discovery phase. • Methods: Formulation of issue statements; development of empathy maps; mapping of customer journeys • Outcome: A clearly articulated and well-defined design challenge.

3. Development • Objective: To generate and evaluate potential solutions for the identified problem. • Methods: Brainstorming; Prototyping; Rapid Testing (User Testing) Outcome: A collection of prototypes or concepts that address the issue.

4. Delivery • Purpose: Execute the completed solution and initiate its deployment. • Methods: Completion Design; Implementation Solution; Measurement Impact • Outcome: A functioning solution, prepared for implementation.

The visual representation (Figure No. 1) of the “Double Diamond” idea delineates two divergent processes (exploring several choices) and two convergent processes (focused on potentially viable solutions):

1. The initial diamond (problem): Divergence for exploratory issues and convergence for their definitions; 2. The subsequent diamond (solution): Divergence for exploring solutions and convergence for the implementation of optimal solutions.

Benefits of Double Diamond framework:

• Clarity and Structure: Offers a systematic approach to resolving complicated challenges.
• User-centric: Place people and their needs at the core of the process.

• Flexibility: Applicable across many domains, including product design, services, and governmental policies.

• Collaboration and Creativity: Promotes the engagement of interdisciplinary teams and rapid experimentation.

Critique and constraint:

• May be regarded as linear, while the process is, in reality, iterative.

• Requires time and resources for efficient implementation. Success is contingent upon the quality of research and user engagement.

3.1. Practical Applications of Double Diamond Product Design: Development of solutions that directly address consumer demands. • Public Policies: Enhanced and more efficient policy execution. • Digital Services: User-centric application development and platform services.

The Double Diamond framework assists teams systematically addressing difficult challenges while keeping the user at the center of the process.

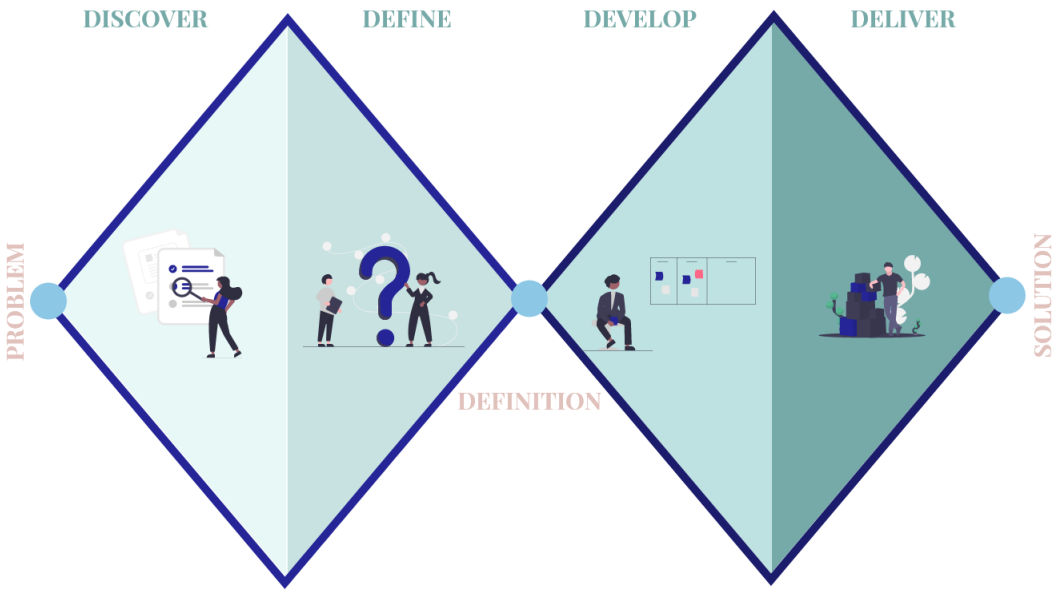

Figure 1. Double Diamond / Design Council of the United Kingdom in year 2019

Source: https://projekter.aau.dk/projekter/files/415128891/

4. The connection between Nudging and Double Diamond

Nudging and the Double Diamond are complimentary ideas applicable in user-centric solution design, particularly in service design, public policy, and consumer behavior. Despite originating from disparate contexts, they can be interrelated to inform the development of successful treatments that impact human behavior. What examines the architectural modeling choices about the use of electricity in urban freight transport and promotes carriers' selection of sustainable options.

Nudging may be included in the Double Diamond approach to provide solutions that subtly impact habits while preserving user autonomy.

1. Discover:

• Identify behavioral streams and the elements that drive them.

• Investigate users to comprehend the rationale behind my decisions (cognitive biases, habits, obstacles).

Examples: Observing decisions made by carriers to comprehend my continued preference for fossil fuel trucks over electric ones.

2. Define:

• Formulating the problem: "How can we devise a solution that promotes desired behavior?"

• Problem statements may encompass: “What strategies may be employed to enhance the electrification rate among carriers?" How can we motivate carriers to conserve energy through saddle SAVE?

• Conduct data analysis to determine the locations and methods for implementing a nudge for A.

3. Formulate:

• Formulating innovative solutions grounded in the principles of nudging, including:

• Default settings: Implicitly configuring certain preferred options (e.g., automatic enrollment in savings programs).

• Social Messages: Communication FACT that "countries such as Germany, France, and the Netherlands have integrated electrification in urban freight transport" to promote adherence.

• Redesign of environmental decision-making: Mandate by legislation.

• Prototyping and evaluating solutions through simulation or pilot studies.

4. Delivery:

• Execution of solutions and assessment of impact.

Examples: Organizing pilot truck "drive test" sessions for electric vehicles by manufacturing for carriers in major metropolitan agglomerations.

• Modify energy bills for A to emphasize consumption in comparison to other nations that have already included electric trucks into urban transport.

In what ways does nudging facilitate the Double Diamond process?

• Validating insights: Researching behavior particular to nudging (observing decisions, testing reactions) might enhance the Discovery phase.

• Prototypes are expedited and iterative: During the development phase, nudging provides straightforward and efficient solutions that can be rapidly evaluated.

• Measurement of success: Nudging relies on minor, quantifiable modifications, facilitating an easier evaluation of impact during the delivery phase.

Advantages of integrating Nudging with the Double Diamond framework:

• Resolutions User-centric: The Double Diamond framework directs the creative process, while nudging guarantees that the solutions are pragmatic and effective.

• Scalability: Nudging facilitates widespread deployment while minimizing expenses.

Quantifiable impact: The integration of user research (Double Diamond) and behavioral testing (nudging) enhances the likelihood of success.

In summary, Double Diamond provides a framework for problem-solving, whereas Nudging introduces a behavioral dimension that enhances the offered solutions. This combination is highly beneficial in formulating effective and lasting solutions.

5. Outcomes

To achieve sustainable development in Romania in alignment with European Union commitments, we must formulate a strategy centered on citizens and future generations concerning the implementation of global trends in "Truck E-mobility" through complementary concepts: NUDGING and DOUBLE DIAMOND.

Specifically, in the context of AUTHOR development, the transformation of the Double Diamond model into a Triple Diamond framework, once embraced by all stakeholders in Truck E-mobility, will facilitate the establishment of a company characterized by equity and solidarity, capable of addressing the challenges posed by global, regional, and national changes.

In contrast to the Double Diamond, which offers a strategic design framework applicable to innovation processes and issue-solving, the Triple Diamond effectively provides a strategic framework for the execution of solutions in problem resolution.

examined the "Double Diamond" idea inside EAEC. The applicability of electrification in urban freight transport is examined by the author, who notes that the two components—Discovery/Definition and Development/Delivery—are intricately connected. However, they must be addressed in a manner that facilitates both a visual representation of standard design phases (problem/solution) and an overview of the implementation/testing process.

This article necessitates the development of three diamonds, envisioned as the "Triple Diamond."

Third diamond visible The author possesses the subsequent phases:

- Training Driver (divergence) / Test Drive (convergence), denoting the procedures designed to apply and evaluate the solution derived from information acquired through observation of the necessity to facilitate the adoption of electric vehicles in urban freight transport.

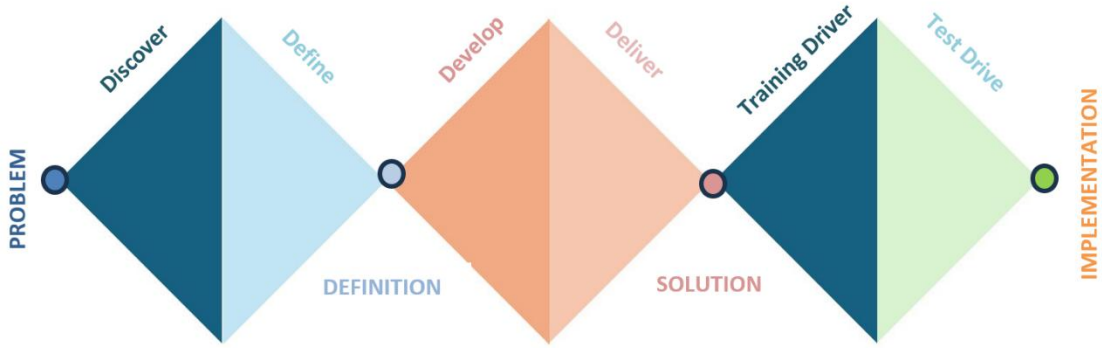

Figure 2. Triple Diamond: Representation visual modified Double Diamond model encapsulates the design process How and implementation

Source: author / contributions PERSONAL

In the Triple Diamond model, the author illustrates that the three diamonds symbolize a process of researching challenges, which may be extensive or profound (divergent thinking), executing targeted actions (convergent thinking), and then implementing solutions. Therefore, the design process has six processes, exceeding the two additional phases typically illustrated in literature according to the Double Diamond design process model, which was popularized by the British Design Council in 2005, specifically:

Discover: comprehend the situation rather than make assumptions about what it is. This step involves engaging in discussions and socializing with individuals impacted by issues.

Define: with the information gathered from the discovery phase, define CHALLENGE in a different way. The concept of challenge utilizing the insights acquired during the discovery phase.

Develop: provide answers different to the problem definition clearly, looking for inspiration from elsewhere part and co -designing with several people different.

Delivery: offer different solutions at scale small.

Training drivers: offer dedicated training sessions for different truck models electric vehicles intended for urban use.

Test Drive: evaluate several electric truck models designed for urban applications for a duration ranging from 2 to 7 days or a minimum distance of 100 km driven, referred to as "Truck E-mobility".

The two additional stages facilitate the monitoring of views and attitudes toward the organization, its goods and services, as well as customer satisfaction and perceptions of mark, and are likely to provide challenges. Including analysis, the candidate is gathering feedback on the company's exploitation by conducting test drives over distances not exceeding 100 km, assessing performance and reception in comparison to rivals.

Through the analysis of this data by the marketing and sales departments, along with other project team members, market gaps can be identified, as well as opportunities for enhancement and innovation in the assimilation and implementation of the "Truck E-mobility" concept from regulatory objectives to practical application.

6. Conclusion

Under the circumstances of "Truck E-mobility," cities face several challenges across various sectors, including the economics, energy, transportation, infrastructure, water supply, environmental protection, and essential services.

To achieve the objectives set by the European Union to reduce greenhouse gas emissions by at least 55% by 2030 and attain climate neutrality by 2050, as outlined in the "European Green Deal," Romania must now devise solutions for the assimilation and implementation of "Truck E-mobility," thereby transforming into one of the future's intelligent cities.

The research indicated that exploring and comprehending fundamental components from specialized literature concerning the brain's organizational modules and their differential responses to events is essential for creating a "nudge" to facilitate the assimilation and implementation of the phenomenon of "Truck E-mobility."

The literature on Nudging and the Double Diamond framework has influenced our research in the creation of the Triple Diamond idea, which centers on the end user of the electric vehicle and may be applied to saddle design. Offer results good outcomes essential for the decarbonization of urban freight transport and line with EU targets (years 2030/2050).

Addressing the mentioned problem in a sustainable manner may involve the adoption of electric truck growth, as evidenced by considerable literature study. We provided a comprehensive analysis of the variables affecting the delayed adoption of electric cars and the constraints that we, as service designers, must consider. When Cream resolves our conceptual issues.

By examining and evaluating recommendations from the specialist literature to develop an effective nudge, the author proposes utilizing these insights in conjunction with our service design tools and the methodologies at our disposal. A research question may be worded as follows: "How can service design be utilized to address the needs of individuals based on sustainable lifestyles?" This research topic will lead us in designing actual, relevant solutions through a case study.

We recognized some notable strengths while also emphasizing areas for future enhancement across a variety of literature, including foundational books on the green economy and sustainable development, as well as specific frameworks such as nudging and the Double Diamond model. This scope provides a robust theoretical framework and contextualizes the importance of truck e-mobility within the broader framework of urban sustainability. The author adeptly integrates design strategy with execution by extending the Double Diamond concept into a Triple Diamond framework.

This conceptual development redefines the design process and underscores the practical challenges of executing sustainable transportation solutions. Our research sought to address the urgent need to reduce emissions in urban transportation while adhering to EU policy goals. The focus on truck electrification due to environmental and regulatory requirements is entirely justified. The discussion on nudging presents an intriguing behavioral dimension to the findings. The essay outlines a sophisticated approach to accelerating the slow adoption of electric vehicles by analyzing how small interventions might affect decision-making. While the theoretical framework is robust, our study heavily depends on existing literature without including significant empirical data or case studies.

Future research may benefit from pilot studies or field trials that validate the proposed Triple Diamond structure in real-world settings.

An additional limitation of our current research is that the transition from the established Double Diamond to the proposed Triple Diamond may be articulated with better precision. Detailed explanations of each phase, especially the "Training Driver" and "Test Drive" components, would improve readers' comprehension of the framework's implementation. Despite the conceptual model's novelty, there is inadequate discussion of the practical

challenges and limitations (e.g., infrastructure, financial implications, stakeholder participation) that may affect its adoption. A thorough evaluation of these challenges would improve the analysis. Moreover, using quantitative metrics (such as performance statistics, cost-benefit analyses, or impact assessments) might provide a more balanced view between theory and practice. Future initiatives may include pilot projects or case studies employing the Triple Diamond framework in actual urban transportation settings. This would not only validate the model but also highlight any necessary improvements for different circumstances. Furthermore, given the multidisciplinary nature of the issue, a thorough stakeholder analysis might provide insights into how diverse organizations (governments, logistics companies, urban planners) can collaborate to resolve implementation challenges. Investigating the lasting impacts of nudging strategies on behavior and the effectiveness of electric vehicles in urban logistics would yield valuable insights into the sustainability and scalability of this method.

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