

Treno Di Notte Greta Thunberg: the Meaning of Sustainability in the Overnight Rail Passenger Market – A Case Study on the Route Hungary – Italy

Zsolt Lévai^{a,*}, Balázs Molnár^b

^aUniversity of Győr, Department of Transport, Egyetem tér 1., 9206 Győr, Hungary

^bMÁV-START Co., Könyves Kálmán krt. 54-60., 1087 Budapest, Hungary

levai.zsolt@sze.hu

This study deals with sustainability issues in transport, focusing on rail and air transport. The background to the research is the need to reduce the carbon footprint of transport, which includes prioritising rail. The current developments in the world: the rise of climate protection and sustainability, increasingly environmentally conscious lifestyles, and the growing media attention on these issues (including Greta Thunberg's activity) suggest that long-distance environmental friendly vehicles like overnight rail passenger trains is likely more to use in Europe. This makes it necessary to improve the rail services. However, previous studies have dealt separately with the environmental issues and the railway development. That is why the scope of the research is to link these two separate topics. In order to achieve the future objectives of the (night) rail market, it is necessary to define what can be meant by rail sustainability, so that the environmental friendliness of this transport mode can be clearly expressed to the public. Therefore, the aim of this research is to determine the relationship between the less polluting rail sub-sector and sustainability by analysing night rail travel compared to short-haul air travel. As a result, the definition of sustainability in rail transport and a case study with the practice of product design methodologies that increase the role of the railway are presented. With the rise of the (night) rail transport, fewer flights will be needed.

1. Introduction

The title is deliberately provocative, as the name of the young environmental activist is known for all, and her consistency in refusing flying is shaping European transport habits as part of a global consumerist fad. The environmental protection movement, which has been reborn many times and in many forms, has thus taken on a new face: social and traditional media have been combined to amplify the voices of young people who want to challenge previous middle-class patterns in their consumer culture. Greta Thunberg's activities are intended to raise awareness of the state of our environment today and of sustainability. There are also other well-known faces of environmentalism around the world, such as David Attenborough and his nature films or Pope Francis with the encyclical *Laudato si'*, which also reach a wide audience. The topicality of the climate change issue is unquestionable and the development trends in developed countries are clearly emerging. In the European political arena, sustainability has become a priority area: Ursula von der Leyen, President of the European Commission, has made it a central concept of her policy. The Commission has launched the preparation of a new White Paper on transport, which is a key step in this direction. This is an initiative of the European Green Deal to make the EU climate neutral by 2050 (European Commission (EC), 2019).

This study therefore compares rail transport with the most polluting air transport. The competitive advantage of rail over short-haul air travel will be presented from a sustainability perspective. The importance of giving passengers a meaningful choice between the two modes of transport is highlighted, and the proposals for improved accessibility and sustainability of rail will be presented as a case study.

The topic of this study is therefore approached from two perspectives: sustainability and the evolution of the rail passenger market. The link between the two areas is the International Union of Railways (UIC), whose 2022 Rail Sustainability Report states that the subsector is the backbone of sustainable mobility (International Union

of Railways (UIC), 2023), and the European Commission's 2019 research, which finds that the sector has advantages in terms of energy efficiency and environmental emissions (Wijngaarden et al., 2019). More recognition of the energy efficiency of rail has come to the fore in the last decade as a consequence of the negative impacts of transport on the planet (Blainey and Preston 2022). The editors of the book argue that rail has a key role to play in achieving zero carbon emissions. Previous research has found that rail helps to reduce greenhouse gas emissions (Pritchard, 2011), but a recent study suggests that there is now a need to focus on a wider range of ecological footprints, such as energy efficiency (Fan et al, 2021). A study in the E7 countries has shown that rail offers a wealth of opportunities for environmental sustainability and economic development (Gymafı et al., 2022), which should be exploited, like energy efficiency.

Approaching the issue from the night train side, researchers have found a positive trend in the development of night trains after the COVID-19 pandemic (Bulková et al., 2022), and a study suggests reducing the operating constraints and ticket prices for night trains to preserve this (Back-on-Track Europe (BoT), 2023). A Swedish study has also found similar results when looking at passenger preferences (Curtale et al., 2023). It has also found that no through-transit is an attraction for night trains. However, the use of overnight trains also depends on passenger attitudes (Bush and Peer, 2022), which increasingly include environmental behaviour. For some tourists with this attitude, rail travel is in principle a real option.

It can be seen that the majority of the research is either on the sustainability of transport or on the competitiveness of night trains, so in this article the competitive advantage of rail over short-haul air transport will be examined from a sustainability perspective, as a novelty. The sustainability in night train transport will be defined, the importance of giving passengers a meaningful choice between the two modes of transport will be highlighted, and proposals for improved accessibility and sustainability of rail will be presented as a case study, which could provide a basis for the re-launch of rail transport between Hungary and Italy.

2. The environmental impacts of transportation

One large group of travel needs is tourism-generated traffic. The development of the global economy and the increasing freedom of movement following the COVID-19 pandemic are encouraging many people to explore and discover the world. The tourism industry continues to expand and develop, further generating demand for mobility. Often can be heard about the technical dimension of the need to move as part of tourism, but it is much more complex than the technical characteristics of transport if it is treated as an inseparable entity from the economic, social, political and cultural dimensions. These travel needs also have a significant impact on the performance of the transport sector. Within the sector railways have a crucial role in a sustainable, safer and greener evolution of the transport system (Cruceanu, 2015).

Some form of propulsion powers the majority of vehicles used for travel. Many pollutants from the combustion of the fuel needed to power conventional, explosive engines are released into the air, changing the climate of the planet and ultimately leading to the loss of our habitat. Air travel has become the main mode of transport for longer distance journeys, but it is also one of the modes with the highest specific emissions. Greenpeace calculated that a Budapest-Venice flight emits 183 kg of hazardous substances per passenger, compared to just 28 kg by rail (Greenpeace, 2023).

Nowadays, perhaps influenced by Greta Thunberg, environmental awareness and sustainability are also playing a role in many people's choice of transport mode. Less polluting but less comfortable modes of travel, such as rail, may also come to the fore. Comfort is used here not only in the ergonomic sense, but also to include everything related to the mode of transport (e.g., availability).

3. Competitive conditions for the rail sector

The building of motorways and the economic development had a knock-on effect, but after a while the pace of road construction could not keep up with transport needs, and the road network became congested. As technology developed, so did aviation, with ever larger and faster planes being built to carry more and more passengers to their destinations faster and faster. The analysis of aviation is dealt with in a separate chapter.

The railway lines built in the 19th century to adapt to the topography could not compete with the motorways built 100 years later in terms of passenger transport. Technical improvements on the railways made it possible to introduce high-speed transport by the early 1980s.

3.1 Day or night travel

Rail transport operates 24 hours a day, meaning trains can run all day. This has allowed the development of two basic forms of rail travel, daytime and night-time.

Daytime travel is done in seated coaches, traditionally in two classes (1st and 2nd class), but nowadays this is limited only by the creativity of the railway companies (e.g., economy, business, etc.). The main development

direction for daytime travel now is to facilitate on-board working by designing the equipment. This will improve travel time efficiency. The proliferation of portable computing devices and wireless internet has made it possible for passengers to carry out office work on board trains. If passengers can do their normal work on board on a laptop during the journey, even the longer journey time is neutral for them and does not result time loss. This is a very important finding because the transport sector has traditionally aimed to increase speed. However, there are situations where 8 hours can be spent more efficiently on a rail car well equipped for work than the same distance on a two-hour flight. Pre- and post-travel procedures in air transport mean that considerably more time is lost because no other activities can be carried out.

3.2 Defining sustainability in the railway environment

In the previous chapter the competitive advantages that make rail transport suitable as a substitute for short- and medium-haul air transport in Europe can be identified on the basis of the analysis. This is particularly true in the market for overnight trains, where travel can also save on accommodation.

An overnight train is considered to be one that offers long-distance travel with an evening, overnight departure and an early morning, morning arrival. Within this scope those trains are meant where sleep is facilitated by the provision of on-board reclining areas.

The key indicator of competitiveness with road and air transport is journey time. The overall sectoral objective is to significantly increase speeds on the main corridors, with targets now in the range of 230-350 km/h. However, an important consideration in the design of such lines is the commercial potential that high-speed railways can satisfy. This may be constrained by the stopping distance, which in such cases should be at least 50 km in order to ensure the sustainability of economically viable operations. Where these conditions exist, high-speed rail transport is certainly preferable in terms of capacity, reliability, land use and specific energy consumption. These advantages are now also visible to passengers, who are becoming increasingly aware of their choice of transport mode (Kupi and Szemerédi, 2021).

For long travel distances, the authors of a Hungarian study have found that high speed can be interpreted as a competitive advantage (Hegedűs and Kaderják, 2022). A study by Italian researchers has shown that the modal share of high-speed rail increased from 27 % to 39 % among the municipalities served by high-speed rail, while the modal share of motorway use decreased from 56 % to 48 % and that of air travel from 10 % to 8.5 % (Cascetta and Coppola, 2014).

Some tourists spend less than 1 day in a given city (hypertourists). They sometimes choose the overnight train between the destinations. Meanwhile, there are trends to deliberately slow down tourism (slow-tourism). One way of absorbing experiences can be to think about them while travelling, to process them, to relax; indeed, the journey itself can be an experience. For this type of tourist, the train can be an ideal means of transport, which is fast enough to allow time for relaxation, and the train journey can be an experience.

On the basis of the above, the relationship between sustainability in the night train market is defined as follows: any night train service connecting significant cities with a catchment area of more than 200,000 people with evening departures and morning arrivals, with an average passenger volume of 150 passengers per service. Likewise, direct services during the high holiday season between prioritised holiday areas (beaches, ski resorts, cultural centres) and large cities, which meet travel demand and help reduce the carbon footprint of tourism.

4. Investigating the rail link between Hungary and Italy

4.1 Methodology

An empirical, questionnaire-based survey was conducted between 11 and 31 July 2022, asking rail passengers where they prefer to travel by train. Our aim was to test this question on a sample of at least 500 people. The work was carried out by face-to-face interviews on trains and at Budapest railway stations, with the possibility of completing the questionnaire online. This gave the opportunity not only to ask people who have (Hungarian) rail experience, but also to ask people who are not rail passengers but would use the service if the conditions were met.

It was not aimed to distinguish between different passenger groups, but only to identify a preferred destination, so cross-tabulations and cluster analysis were not performed. As for the destination, the answer was open (open question) and destinations accessible by rail were not offered, but left it to the respondents to specify the destination and then to examine the possibility of serving them by rail (the question included where they would travel by train). A total of 584 responses were received, so the minimum target was met.

Due to the free responses, respondents gave a total of 345 different destinations, which shows that there is a very wide range of places people would like to travel to by train. As a result, the most popular destination did not receive more than 40 votes. The Balaton region in Hungary was selected by 40, Vienna and Austria by 40, Italy, Rome, Milan and Venice by 34, Croatia by 16, Germany, Berlin and Munich by 26 and the Czech Republic and Prague by 14 (Figure 1).

Rail services to the first two destinations are fully adequate. During peak hours, both destinations are accessible from Budapest with hourly trains offering quality services. The question of rail accessibility to the third popular destination, Italy is much more interesting. There is currently no direct train service to the Appennini Peninsula, but the responses confirm the need to re-establish access.

This leads to the conclusion that, in certain cases, Italy may have enough passengers to create a demand potential that direct trains can be discussed in any case, but high-speed services can be discussed theoretically. Based on the above, it can also be concluded that rail access in Italy could be one of the areas for development where high-speed services could be seen as a competitive advantage for the sector.

Reaching Italy does not in itself justify the construction of high-speed lines. Such lines are efficient on routes where there are enough destinations to allow the capacity of the line to be ideally utilised by high-speed trains. For this reason, it will therefore be shown below that it is not practical to design the link along the geographically shortest route.

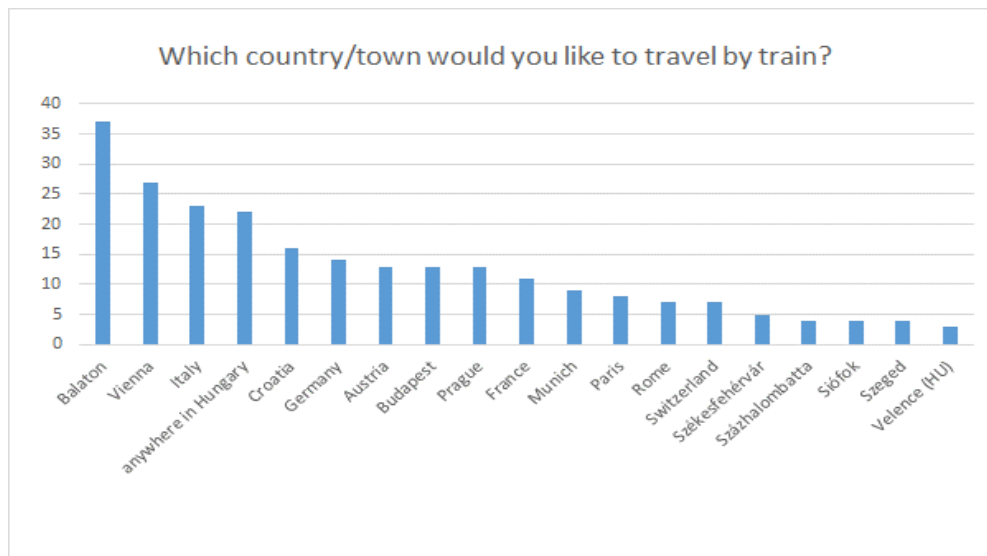


Figure 1: Where would you like to travel by train? (Source: own research)

4.2 Product designing

Italy's geography, history and culture offer travellers a wide range of destinations. It can be as much a destination for holidaymakers looking for beaches as for tourists visiting the cities. The elements of 3/4S tourism (sea, sun, sand and sights) play a significant role in destination selection (Alipour et al., 2020) and Italy has all components. The fundamental objective is that the needs of seaside and cultural tourism to Italy, as well as business travel can be satisfied by train. Convivial travellers do not require special services, so the focus of the planning is on demanding business and price-sensitive leisure tourists.

The 3S tourists' destinations are the seaside resorts, especially on the Adriatic coast, but for cultural tourism, the country can be a destination for almost all of its attractions. In addition to the open water, Italy also offers many destinations for lake lovers and winter sports: the ski resorts of northern Italy are also popular. The latter destinations are difficult to reach by rail, but seasonal demand may make it worthwhile to consider access, with Bolzano as the rail destination. Onward travel to the ski resorts is possible by bus transfer.

The same problem of accessibility is to a lesser extent also present for beach holidays. In the northern Adriatic area, the railway line does not run directly along the coast, and the nearest popular resorts such as Bibione, Caorle and Jesolo have only indirect stops (Latisana-Lignano-Bibione, Portogruaro-Caorle, San Donà di Piave-Jesolo), so in these cases a shuttle service is also required. Only Trieste has a downtown and coastal railway station, with the disadvantage that the dead-end station is only accessible from Hungary by a detour, meaning that onward trains have to change direction here. This is a disadvantage from a rail business point of view, as the operation takes 12-20 minutes for conventional locomotive traction, while a 2-3 minute stay would be enough for passenger traffic reasons. A stopover in Trieste could add up to an hour to the journey time.

On the western Adriatic coast, the railway runs much closer to the resort area, the tracks are practically placed on the beach. It is therefore much easier to serve these resorts, as trains only need to stop at the major centres. However, it is more difficult to plan rail connections, as there is no major city on this stretch of coast that would be an ideal terminus. Here, on the one hand, the technological conditions for reversing the train would need to

be in place and, on the other hand, as the end point is displayed on the info-monitor for trains, it is advisable to choose a destination with a high marketing value. This is not the case on this stretch of coast. The final destination of the train could be Ancona or Pescara. However, the profitability of such a train is doubtful. Based on international rail transport experience, a train could be planned seasonally for such a destination, using more obsolete equipment.

The motivations of visitors to cities can be multi-faceted. Professional or health tourists, for example, can indulge their cultural passions, enjoy the sights and culinary experiences in their free time. Visitors from further afield are most likely to seek out the cultural experiences of a particular city. In addition to the natural and architectural heritage, they are looking for other cultural experiences. For this reason, the cities with the highest tourist flows are not those with a single main attraction, but rather those that are regional centres and have a mix of many cultures (e.g., Milan). The visibility and cultural role of Venice, the most accessible city from Hungary, does not need to be demonstrated. Its most important event is the Carnival in February. Florence is a real cultural gem. Its medieval buildings and palaces are a magnet for lovers of architecture. Another cultural city is Pisa, less than 1 hour away by train from Florence. Before Florence, a stop in Bologna or, for coastal trains, in Rimini, a 50-minute bus ride from the Duchy of San Marino, is necessary to see. Both cities offer a wealth of historical and cultural attractions. High-speed rail transport can also bring Rome and Naples closer. The sight of the unadulterated southern Italian city of Vesuvius will inspire many to travel.

The business risk of implementing a direct connection can be reduced if the night train does not serve a single destination, but is organised into a network through night shunting. In practice, this means sending 2 groups of wagons from both Prague and Budapest to Vienna, there they are divided and exchanged and will be sent as direct connections to Milan and Rome from both origins. The created destinations are the followings:

- Budapest – Vienna – Rome,
- Budapest – Vienna – Milan,
- Prague – Vienna – Rome,
- Prague – Vienna – Milan.

One of the findings of the Hungarian research was that the choice of transport mode is determined by the time spent in the vehicle (Hegedűs and Kaderják, 2022). Therefore, in this section, there will be presented options for vehicle design to ensure that passengers feel comfortable during the journey.

There are already several types of high-speed trains in Europe. Their basic characteristic is that they are motor units, which is ideal for Italy because they can change direction fast when necessary. This requires that the driver to the opposite direction is waiting for the train at the station and that the necessary data reconciliation is carried out by special IT tools, so that the whole process taking no more than 4 minutes.

The planned speed in Hungary requires the purchase of a 350 km/h vehicle. Similarly, it is a requirement that the vehicle is operational under all overhead line systems used on the route. Ergonomic comfort is one of the most important considerations for rail users in international traffic. Ergonomic comfort in itself is a difficult concept to define. It is primarily understood to mean the spaciousness of the wagons, the interior colour scheme, the design and layout of the seats and the luggage space. Practical extras (such as a table, power socket, luggage rack on the floor) and elements that give a sense of luxury (serving food or drinks, reclining seats, adjustable lighting) are very important.

Due to the length of the journey, the train set-up must include catering services, which, keeping the traditions of Hungarian cuisine, means mostly dining cars and, for breakfast, continental, on-site service. The seatings on night trains are basically the traditional day coaches, but sleeperette coaches have been specially designed for night travel. Bicycle transport and WIFI are now a standard requirement. Trains towards to tourist destinations are equipped with bicycle storages. This may be a dedicated section in a seated carriage or a carriage for bicycles only; motor units are equipped with bicycle storage. For disabled people, the so-called multi-purpose (multifunctional) carriages are designed, with disabled lifts and special spaces for wheelchairs. The waggons can also be used by people with pushchairs and cyclists. Because of the length of international journeys, dining cars were used in the past. The increase of travel speeds has called into question the need for railcars to provide catering services, but the demand for on-board catering services has remained. The reaction of rail companies was to offer on-board bistro services, offering sandwiches, snacks and drinks, but no longer offering full meals according to the length of the journey. Today, these can even be delivered to your seat by the waiters, and orders can be placed via a phone app (for example on ÖBB Railjet trains).

Night-time traffic now runs at speeds of up to 200 km/h. However, high-speed sections in Italy and the planned high-speed sections in Hungary can go faster. A major challenge for the rail industry is whether it can build economically viable night trains with a top speed of 350 km/h. High-speed vehicle platforms are already in production that are modular in design and can be configured with any interior space. The most important question is how to accommodate night equipment in a train with a basically open space seating configuration. It is likely that the interior design of the well-separated compartments of sleeping cars cannot be imitated due to

the characteristics of the vehicle. Another theoretical possibility is that, in response to growing demand, the European rolling stock industry will develop a single type of night train that can run on high-speed lines across the continent and that many operators will require, so that the development and production costs are reasonably recovered. In fact, the Budapest-Rome night link can only compete with air travel in time with high-speed (300-350 km/h) equipment. It is then possible to ensure an evening departure to the other end in the morning.

5. Conclusion

The results of this research, the definition of the relationship between sustainability and night rail travel and the presentation of the product design elements on a Hungarian – Italian rail route, may be responses to the findings of previous research that has confirmed the hypothesis that green transport policies have achieved goals that promote environmental friendliness (Ku et al., 2021). Greening transport by prioritising railways can also help people make environmentally conscious decisions not to pollute the planet with their travel. To this end, further research is needed to determine the range of night-time rail services to be able to offer a realistic alternative to short-haul flights and a suitable complement to high-speed daytime trains, not least to offer more cost-effective travel due to the savings in accommodation costs. Hopefully this direction can be the right one for transport sustainability and for Greta Thunberg as well.

References

- Alipour H., Olya H., Maleki P., Dalir S., 2020, Behavioral Responses of 3S Tourism Visitors: Evidence from a Mediterranean Island Destination, *Tourism Management Perspective*, 33, 100624.
- Back-on-Track Europe (BoT), 2023, All aboard – travelling Europe by night: Towards cheaper night trains for people.
- Blainey S., Preston J., 2022, Sustainable Railway Engineering and Operation, *Transport and Sustainability*, Vol. 14, Emerald Publishing Ltd., Bingley, UK.
- Bulková Z., Delík M., Gašparík J., 2022, The Potential of Night Passenger Trains in Europe in the Post-pandemic Period, *Transport technic and technology*, 18:2 7–14.
- Bush B., Peer S., 2022, Environmental Concern and the Determinants of Night Train Use: Evidence from Vienna (Austria), *Institute for Multi-Level Governance & Development*, Vienna University of Economics and Business
- Cascetta E., Coppola P., 2014, Competition on fast track: an analysis of the first competitive market for HSR services, *Procedia Social and Behavioral Sciences*, 111, 176 – 185.
- Cruceanu, C., 2015, Sustainability of Railway Transport System – An Overview, *Advances in Environmental and Agricultural Science*, 214–223.
- Curtale R., Larsson J., Nässén J., 2023, Understanding preferences for night trains and their potential to replace flights in Europe. The case of Sweden, *Tourism Management Perspectives*, 47, 101115.
- European Commission (EC), 2019, What is the European Green Deal? <ec.europa.eu/commission/presscorner/detail/en/fs_19_6714> accessed 24.07.2023
- Fan Y.V., Klemeš, J.J., Wan Alwi S. R., 2021, The environmental Footprint of Renewable Energy Transition with Increasing Energy Demand: Eco-Cost, *Chemical Engineering Transactions*, 86, 199–204.
- Greenpeace, 2023, Ticket prices of planes vs trains – a Europe-wide analysis, *Greenpeace Central and Eastern Europe*, Vienna, Austria.
- Gymafi, B.A., Bekun F.V., Balsalobre-Lorente D., Onifade S.T., Ampomah A.B., 2022, Beyond the environmental Kuznets curve: Do combined impacts of air transport and rail transport matter for environmental sustainability amidst energy use in E7 economies?, *Environment, Development and Sustainability*, 24, 11852–11870.
- Hegedűs M., Kaderják P., 2022, Módválasztási szokások a hazai távolsági utazások esetén, kitekintéssel a nagysebességű vasúti fejlesztésekre, In: Horváth G., Horváth B. (Ed.), XX. European Transport Congress / XII. International Conference on Transport Sciences, Győr: After pandemic - before autonomous transport, Közlekedéstudományi Egyesület (KTE), Győr, Hungary, 647–657.
- International Union of Railways (UIC), 2023, 2022 Global Rail Sustainability Report, UIC, Paris, France.
- Ku D., Kim J., Yu Y., Kim S., Lee S., Lee S., 2021, Assessment of Eco-Friendly Effects on Green Transportation Demand Management, *Chemical Engineering Transactions*, 89, 121–126.
- Kupi M., Szemerédi E., 2021, Impact of the COVID-19 on the Destination Choices of Hungarian Tourists: A Comparative Analysis, *Sustainability*, 13, 13785.
- Pritchard J.A., 2011, The potential of the railway to reduce greenhouse gas emissions, *Energy Efficiency First: The Foundation of Low-carbon Society*, ECEEE Summer Study, Southampton, UK.
- Wijngaarden L., Schroten A., Essen A., et al., 2019, Sustainable transport infrastructure charging and internalisation of transport externalities: executive summary, *European Commission Directorate-General for Mobility and Transport*, DOI: 10.2832/246834.