

T4<2° – Transport For Under Two Degrees Questionnaire Delphi Survey Round 2

The first round of the T4<2° Delphi survey was a great success. Alongside yourself, around 300 distinguished experts from various sectors and disciplines from 57 countries participated shared their vision on the future of transport. Thank you very much for forming part of that group!

Now, we would kindly invite you to participate in the second round of the Delphi survey.

It will approximately take up to **30 minutes** to answer the questions.

Once the analysis of all results has been finished, you will receive the final report.

T4<2° is jointly realized by the World Economic Forum, Agora Verkehrswende, and GIZ on behalf of the German Federal Foreign Office. For any questions or comments, do not hesitate to contact us at t42@giz.de.

Thank you very much!

Commissioned by:



Implemented by:



NOTES FOR FILLING IN THE QUESTIONNAIRE:

To go to the next page, please click on "next page". If you would like to answer questions that have already been answered, please use the "previous page" button. The progress bar on the upper part of the page gives you an indication, how far you are through the questionnaire.

During the survey, you will notice some words in **green**. You can hover above them with the cursor to see a detailed explanation.

The invitation link has been created individually for you and can be used by one person only. You can interrupt the survey and continue at a later point in time. Your answers are saved automatically.

GEOGRAPHICAL CONTEXT:

If it is not specified in the question, please answer the questions with regard to your individual geographic working and living context. The comment spaces on each page give you the opportunity to add any further remarks you may have. We do specifically invite you to elaborate on a statement/answer if you think that it applies only to specific countries or regions of the world.

METHODOLOGY OF THE SECOND ROUND:

You will be invited to answer the questionnaire once again while being able to see and consider the results from the first survey round. Thus, you can re-evaluate your position in comparison to the overall opinion. This procedure is typical for Delphi surveys and leads to a validation and sharpening of the overall results.

The questionnaire will look like the following example:

Cities and coalitions of cities (as opposed to national governments) will be the main political actors shaping the future of transport worldwide.

Results from the 1st round:

strongly agree 21%

agree 52%

disagree 21%

strongly disagree 2%

I don't know 4%

- strongly agree
- agree
- disagree
- strongly disagree
- I don't know

During the first survey round we received many very helpful comments and critique concerning the content and format of the questionnaire. We tried to consider these hints as much as possible when adjusting the questionnaire for the second survey round.

As well, we would like to emphasize that we will take into account all of your comments and statements for the final interpretation of the results and for the preparation of the final study report.

PRIVACY DECLARATION:

This survey is administered by the Institute for Innovation and Technology (iit) at the VDI/VDE Innovation + Technik GmbH on behalf of Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

The Institute for Innovation and Technology commits to maintaining the confidentiality in the handling of the data. All analysed data will be processed only in an anonymous and aggregated manner for the project's purpose. All data will be processed in relation to lawfulness, purpose limitation, data minimisation, accuracy, storage limitation, integrity and confidentiality in accordance with art. 5 GDPR. For more information please see the Data protection information.

- I declare my consent with the Privacy declaration above.

Actors and Challenges of the Transport Transformation

The following questions will explore your opinion on key international actors and main challenges that will shape the development of the global transport sector in the next 30 years.

Please rank the following six challenges for decarbonising transport by mid-century, starting with the most significant challenge.

vested interests of incumbent industries (1st Rank in 1st round)	1st rank	
lack of regulatory action	2nd rank	
lack of international co-ordination and co-operation	3rd rank	
lack of public acceptance	4th rank	
lack of suitable technologies	5th rank	
slowing economic growth	6th rank	
high infrastructure investment cost		

- I don't know
- Other (please specify):

If you want, please share your reasons or any other remarks with us.

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Which three countries will be most influential for the success of the global transport transformation?

- Rank 1:
- Rank 2:
- Rank 3:

Which three countries will be most influential in slowing down the global transport transformation?

- Rank 1:
- Rank 2:
- Rank 3:

Which three countries will experience the most adverse consequences from the global transport transformation?

- Rank 1:
- Rank 2:
- Rank 3:

Cities and coalitions of cities (as opposed to national governments) will be the main political actors shaping the future of transport worldwide.

<input type="radio"/> strongly agree	<input type="radio"/> agree	<input type="radio"/> disagree	<input type="radio"/> strongly disagree	<input type="radio"/> I don't know
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With the shift of demand towards new commodities such as minerals and rare earths the risk of geopolitical conflicts will ...

- decrease
- increase
- stay the same
- I don't know

Please select and rank the three fields of international governance that require the most action in order to enable a transport transformation.

energy
transport
trade
development co-operation
international standardisation
security
regulation of transnational communication (i. e. standards for telecommunication and postal service)

1st rank	
2nd rank	
3rd rank	

- I don't know
- Other (please specify):

Which three international organisations will be most influential for the success of the global **transport transformation*?**

- Rank 1:
- Rank 2:
- Rank 3:
- Other (please specify):

** The **transport transformation** will ensure that the transport sector is carbon neutral by 2050. Lowering energy usage and covering the remaining demand with carbon-neutral energy will be essential for this large-scale transformation. Hence, the transport transformation necessarily rests on two pillars: the mobility transition and the energy transition in transport. While the mobility transition will reduce energy consumption without limiting mobility by changing how people get around, the energy transition in transport is primarily a technological challenge that will cover remaining demand with carbon-neutral energy.*

If you want, please share your reasons or any other remarks with us.

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Policy Instruments for a successful Transport Transformation

The following questions specify which kind of policy solutions will be needed in order to accomplish the decarbonisation of the transport sector by mid-century.

Please answer the questions with regard to your individual geographic working and living context.

In order to achieve the transport transformation by mid-century, ...

In the first survey round experts voted that both regulations and incentives are equally of high importance and that policy should strongly influence both technology and behaviour.

If you would have to choose only one of these policy-option, which one would you select?

... policy should make use of:

- behaviour
- technology

... policy should mainly influence:

- behaviour
- technology

In your opinion, which five policy instruments would be most effective for decarbonising the transport sector in your country by mid-century?

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.....

.....

Which five of these policy instruments do you see as most likely to be implemented?

	most effective for decarbonising	most likely to be implemented
Regulation:		
carbon tax / fuel-pricing	<input type="radio"/>	<input type="radio"/>
fuel economy standards	<input type="radio"/>	<input type="radio"/>
phase-out of vehicles with combustion engines	<input type="radio"/>	<input type="radio"/>
minimum quotas for zero-emission vehicles	<input type="radio"/>	<input type="radio"/>
road pricing	<input type="radio"/>	<input type="radio"/>
parking management	<input type="radio"/>	<input type="radio"/>
zero-emission vehicle zones	<input type="radio"/>	<input type="radio"/>
Incentives:		
investment in public transport	<input type="radio"/>	<input type="radio"/>
investment in railway infrastructure	<input type="radio"/>	<input type="radio"/>
investment in active transport modes*	<input type="radio"/>	<input type="radio"/>
tax reliefs for low-emission transport modes coupled with higher taxes for high-emission modes	<input type="radio"/>	<input type="radio"/>
free public transport	<input type="radio"/>	<input type="radio"/>
financial support for electric vehicles	<input type="radio"/>	<input type="radio"/>
public procurement focusing on low-emission solutions	<input type="radio"/>	<input type="radio"/>
measures to stimulate avoidance of transport	<input type="radio"/>	<input type="radio"/>
mix-used zoning** in urban planning	<input type="radio"/>	<input type="radio"/>
improvements in cycling infrastructure	<input type="radio"/>	<input type="radio"/>

Information:		
education in schools	<input type="radio"/>	<input type="radio"/>
information campaigns	<input type="radio"/>	<input type="radio"/>

Other (please specify):

* e.g. walking, cycling

** *Mixed-used zoning* is a type of urban development or urban planning that blends residential, commercial, cultural, institutional, or entertainment uses into one space, where those functions are to some degree physically and functionally integrated, and that provides pedestrian connections.

Do you think a politically forced phase-out of incumbent and fossil fuel-driven technologies* is needed in order to decarbonise the transport sector by mid-century?

- yes, immediately
- yes, in 10 years
- yes, in 20 years
- yes, in 30 years
- not at all
- I don't know

* These include for example privately owned, internal combustion vehicles.

Digital Impact

Digitalisation will be a key factor in transforming the transport sector. This trend comprises for example the connection of vehicles to mobile phones and other devices, the spread of mobility platform services or autonomous driving. The following questions explore a wide range of possible consequences of this development.

Please answer the questions with regard to your individual geographic working and living context.

I expect that digitalisation in the transport sector will...

	not at all					very much	I don't know
increase demand for international governance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
contribute to a decrease of greenhouse gas (GHG) emissions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
increase social equity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
close the urban-rural divide	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
give rise to significant energy consumption in data processing and transmission	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
cause problems related to data privacy concerns	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>

By mid-century I expect autonomous vehicles (AVs) to...

	not at all			very much		I don't know
dominate the vehicle market	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
play a significant role in road passenger transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
have increased urban sprawl	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
be all shared and pooled	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
have increased transport volumes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
have narrowed the urban-rural divide	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
have increased social participation of children, older people and disabled persons	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
have increased social participation of economically disadvantaged persons	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
have reduced road injuries and deaths	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
be provided by the state rather than by private entities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Societal Effects of the Transport Transformation

The change of the transport sector will have a variety of effects on society. At the same time technological innovations and trends are affecting the development of the transport sector. The following questions focus on these interrelations.

Please answer the questions with regard to your individual geographic working and living context.

The transport transformation...

	strongly agree	agree	disagree	strongly disagree	I don't know
will create more new jobs than it eliminates.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
will decrease the social divides.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
will decrease gaps in sustainable development.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
will decrease gender divides.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
will decrease racial divides.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
will increase social participation of underserved communities such as people living in "transit deserts", people with low incomes, the elderly, people with disabilities and children.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The spread of the following solutions and trends can potentially lead to a significant decrease in transport emissions especially due to avoided transport. Please rank the trends and applications according to their net emissions reduction effect.

3D printing	1st rank	
advanced telecommunication	2nd rank	
virtual reality applications	3rd rank	
flexibility schemes for employees	4th rank	
e-commerce	5th rank	
home entertainment solutions	6th rank	
sustainability lifestyles	7th rank	
decentralised city-planning	8th rank	

Capital and Markets

The following questions focus on economic implications and the capital needed to achieve the transport transformation.

Which sources of capital will be available in due time in order to finance the global transport transformation?

- sufficient private capital will be available but not sufficient public funds.
- sufficient public funds will be available but not sufficient private capital.
- both public and private capital will be available in sufficient quantities.
- neither public nor private capital will be available in sufficient quantities.
- I don't know

Economic growth and growth in transport demand...

- are strongly linked and cannot be separated.
- will only be decoupling in developing economies
- will be decoupling in developing and developed economies
- will only be decoupling in developed economies
- I don't know.

Fuelling the Transport Transformation

Getting the fuel mix right for vehicles, airplanes and ships will be decisive for achieving the transport transformation. The following questions will focus on the specific fuel mixes for land-based and maritime transport as well as aviation.

Please select and rank: Which three types of fuel do you expect to have the biggest share in land-based passenger transport by mid-century:

direct use of renewable electricity
hydrogen from renewable sources
synthetic fuels from renewable sources
biofuels from agricultural and forestry products
biofuels from waste and residues
oil-based liquid fuels
natural gas

1st rank	
2nd rank	
3rd rank	

- I don't know
- Other (please specify):

Please select and rank: Which three types of fuel do you expect to have the biggest share in land-based freight transport by mid-century:

direct use of renewable electricity	1st rank	
hydrogen from renewable sources	2nd rank	
synthetic fuels from renewable sources	3rd rank	
biofuels from agricultural and forestry products		
biofuels from waste and residues		
oil-based liquid fuels		
natural gas		

- I don't know
- Other (please specify):

Please select and rank: Which three types of fuel do you expect to have the biggest share in aviation by mid-century:

direct use of renewable electricity	1st rank	
hydrogen from renewable sources	2nd rank	
synthetic fuels from renewable sources	3rd rank	
biofuels from agricultural and forestry products		
biofuels from waste and residues		
oil-based liquid fuels		
natural gas		

- I don't know
- Other (please specify):

Please select and rank: Which three types of fuel do you expect to have the biggest share in maritime transport by mid-century:

wind power	1st rank	
direct use of renewable electricity	2nd rank	
hydrogen from renewable sources	3rd rank	
synthetic fuels from renewable sources		
biofuels from agricultural and forestry products		
biofuels from waste and residues		
oil-based liquid fuels		
natural gas		
other / please specify		

In order to integrate the transformation of the energy and transport sectors...

- the extension of renewable energy capacities needs to be prioritised over **grid flexibility***.
- grid flexibility needs to be expanded first.
- renewable energy capacities and grid flexibility need to be developed hand in hand.
- I don't know.

** Grid flexibility measures include, inter alia, extension of the existing electricity networks, building up storage capacities, establishing market designs that incentivise flexibility (e.g. storage, shift of consumption to low-demand times), solutions for more efficient grid management.*

Modes of Transport

It can be expected that modes of transport in urban and rural areas will have changed significantly by mid-century due to new technologies, service offers and reformed spatial planning.

Please answer the questions with regard to your individual geographic working and living context.

Which modes will dominate *urban* transport by mid-century?

Cascaded selection (*second and third selections will open once prior selection is made*)

First level:

- cars
- two- and three wheelers
- taxis and mini busses
- public transport (busses, metros, trams etc.)
- bicycles
- walking
- passenger drones
- cargo drones

Second level:

Which ownership model will be dominant for the selected modes?

(except for mass transport, walking)

- individually owned
- shared
- pooled

Third level:

How will the selected modes be powered? *(except for walking)*

- Electrically with batteries in the vehicle
- Electrically with fuel cells in the vehicle
- By internal combustion engines

Which modes will dominate *rural* transport by mid-century?

Cascaded selection (*second and third selections will open once prior selection is made*)

First level:

- cars
- two- and three wheelers
- taxis and mini busses
- public transport (busses, metros, trams etc.)
- bicycles
- walking
- passenger drones
- cargo drones

Second level:

Which ownership model will be dominant for the selected modes?

(except for mass transport, walking)

- individually owned
- shared
- pooled

Third level:

How will the selected modes be powered? *(except for walking)*

- Electrically with batteries in the vehicle
- Electrically with fuel cells in the vehicle
- By internal combustion engines

Final Remarks

Which of the following technologies that are still not market-ready will in your opinion play a significant role in transport by mid-century?

	low relevance					high relevance	I don't know
Hydrogen from renewable energy sources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
High capacity energy storage/batteries	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
Power-to-X	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
Hyperloop	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
have increased transport volumes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>

By when will the global transport sector be decarbonised*?

2030	2040	2050	2060	2070	I don't know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

** Decarbonisation is understood as the reduction of carbon dioxide emissions in all areas of the respective sector with the aim to become net-emission free. It includes emissions created over the lifecycle of appliances and facilities as well as reductions achieved through balancing mechanisms such as emissions trading*

Do you have any topics or remarks that have not yet been mentioned in the questionnaire and that you would like to share with us?

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General Data

Please select your country:

.....

Please choose your gender:

- male
- female
- other
- no answer

Please select the sector in which you are predominantly active:

- Politics/public administration
- academia/research
- private sector
- civil society/NGO

Which thematic field are you primarily working in?

- transport
- energy
- foreign policy
- development cooperation
- digitisation
- other (please specify):

How many years of professional experience in relevant thematic areas do you have?

- up to 3 years
- 3 to 5 years
- 5 to 10 years
- more than 10 years

Thank you very much for participating in our project “T4<2° – Transport for under two degrees”!

We highly appreciate that you took the time to participate in the two survey rounds and shared your expertise and opinion with us!

Your contribution to the findings of this unique expert consultation will be translated into **recommendations for action** for **decision-makers in transport and foreign policy** as well as international co-operation.

Once the analysis of all results has been finished, you will receive the final report.

But T4<2° – Transport for under two degrees will not be finished after that! It is our goal to keep the global expert discussion going. We would be happy if you would follow our activities and events on www.t4under2.org.

Your e-mail address will only be used to contact you for this Delphi survey and will not be stored in any other database. Your answers to the survey will not be linked to your personal and contact data in any way.