Future of Super Intelligent Transport Systems

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Authors:	Marie-Pauline van Voorst tot Voorst vanvoorst@stt.nl
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Purpose

The purpose of the exercise is to offer business people, policy makers and politicians lines of approach to determine strategy, policymaking as well as initiatives for change by presenting future visions and an accompanying agenda for the future with respect to transportation of people and goods in the Netherlands of 2040.

Integrating Socio-Economic Trends & Emerging Technologies into Mobility

Reinventing mobility is more than just "reinventing the car". It involves the development of a new mobility paradigm and a full-scale alteration of the transport system. Mobility denotes the transportation of objects over a certain distance, in a certain environment, the movement of people, their patterns of life, work and recreation. The increasing speed at which time and place of social and commercial life takes place creates demand for new kinds, modes and scales of mobility. What will mobility look like 30 years from now?

Mechatronics, nano-electronics, interconnectivity and intelligent software will increasingly play a role in people's daily lives. These technologies affect all societal domains and will have a great impact across all sectors of society. These developments have an enormous effect on the attitude and behaviour of human beings; interaction between technology and its users becomes an ever more crucial factor in finding solutions for problems in any domain, including mobility. Hence, implementing new technological solutions requires an integral approach from different disciplines.

Mobility Outlook for 2040

The main question of this foresight study is: why and how will the citizens of the Netherlands transport themselves and their goods 30 years from now super intelligently?

In order to answer this question, a set of four possible future visions will be defined (not necessarily conceivably probable or preferable). Each of the future visions will be accompanied by an agenda for the future. It will outline strategic questions regarding a preferred transition model. A complete system change seems inevitable and technologically attainable options will be given as well as suggestions for 'no regret' activities, input for future feasibility studies, and questions for further scientific research and experiments.

The target audience of this foresight study are (Dutch) business people, policy makers and politicians.

Super Intelligent: Human-Machine Interaction and Beyond

In this study, transport is considered to be a function within a society. Transport is a derived activity required to fulfil other (personal) needs like work, education, doing groceries etc. In our opinion, an integral transport system includes both the transport of people and goods. Transport can be physical but also virtual or a combination of both.

The term 'super intelligent' is to be interpreted not solely from a technological perspective, but also from the perspective of interaction between a machine or intelligent network, on the one side, and a human being, on the other. The challenge is to think beyond current possibili-

ties and to consider, among others, transport systems that can regulate, manage and perform autonomously.

Dutch society, with its own set of demographics, economics, spatial planning and government, is the focus area of this study. Mobility will be addressed within and between cities as well as in rural areas, including interconnectivity between these places.

Technology as well as human behaviour and society are important aspects in this study.

Broad Assessment of Transportation Needs

The Netherlands Study Centre for Technology Trends (STT) organises this study, which is managed by a Project Manager with support of the STT office, under supervision of a Steering Committee. The Steering Committee monitors the progress as well as the cross-sector dependency, consistency, structure and overall logic of the project. STT foresights are based on a participatory approach with members from many different disciplines.

A broad Market Vision Group with Dutch CEOs provides its vision on challenges, acceptance and risks in bilateral talks. A Technology Vision Group analyses future technological innovations from a sector or functional domains and works towards an integrated view. A Behaviour Vision Group analyses changes in, for example, societal and behavioural attitudes and acceptance.

The results of desk research, individual interviews and the outcomes of the interactive and creative meetings of the different vision groups have resulted in four scenarios. To stimulate ideas across domains, each of the scenarios will be deliberated on by a mix of members of the Technology and Behaviour Vision Groups and some external organisations. For each scenario, we will determine the transportation needs and translate them into possible transport systems. The final future visions will be validated in an expert meeting with the members of the different vision groups and external experts.

The broad and participative setup of STT studies instigates commitment for follow-up actions already during the course of a study, not least because a cross-disciplinary and cross-company network is established.

Participants

Over 80 people from industry, knowledge institutes and government agencies are involved in this participative study. Among the participants are representatives of the following organisations:

Industry: Arcadis, Cap Gemini, Cisco, ECT, Essent, IBM, INROADS, NXP, Schiphol, Segway, Siemens, Spijkstaal, TomTom.

Knowledge institutes: Delft University of Technology, Eindhoven University of Technology, Next Generation Infrastructures, Rotterdam University (Hogeschool Rotterdam), Tilburg University, TNO, University of Groningen, University of Twente, VU University Amsterdam.

NGOs: ANWB, Connekt, KIVI NIRIA, Agrologistics Platform (Platform Agrologistiek).

Government agencies: Dutch Ministry of Economic Affairs, Agriculture and Innovation, Ministry of Infrastructure and the Environment, NL Agency.

Five Major Trends Give Input for Scenarios

This study is still in progress. Therefore the findings mentioned below are provisional.

As transport is considered a function within a society, future developments within the society are the starting point for exploring future transportation needs – notwithstanding the fact that we are aware that future technological developments will also have an impact.

Through desk research, interviews and group meetings, we have chosen several relevant (worldwide) socio-economic trends. Out of these, we have identified the following five trends as most relevant for future transportation needs for diverse future visions:

- *Urbanisation*: the degree and manner of urbanisation affect the transport patterns of people and goods.
- *Demographic developments*: population growth, increase in number of elderly citizens, relative decrease in number of young people – different age cohorts spend their time differently and hence have different transportation patterns.
- *Individualisation*: what effect will the growing dominance of each person's needs on (public) transport be?
- *Informatisation*: informatisation changes the nature of services and the distances goods have to travel.
- *Globalisation*: the distance to be covered has an impact on the transportation mode used.

These trends and their possible counterparts are input for the framework in which the four scenarios will be developed.

Framework: A Person's Needs

Following the trends above and considering other frameworks, such as that of CPB (2010) (see references), we have defined our own framework in which a human being and his/her needs to live, work and recreate are at the core. A person's needs, focus and preferences are the underlying thought behind the proposed

framework. The two trends of individualisation and globalisation (and their possible counterparts) are set against each other to define the four future scenarios. Other relevant trends (and possible trend breaks) are used to complete the description of the four scenarios.

The degree of individualisation is believed to indicate a person's preference for individual or collective transport of people. As for the transport of goods, it indicates the desire for more 'tailor-made' or more mass-produced goods and therefore the possibilities (and restrictions) in production, transportation and delivery of goods and services.

The degree of globalisation (geographical orientation) determines the distance that people, goods and services have to travel. With these two dimensions, participants are invited to consider two important aspects of transport: the number of items to be transported and the distance to be covered. By differentiating those two aspects, we believe the four future visions will be sufficiently distinct.

As stated before, this framework is not based on an existing model and therefore does not have a direct connection to other foresight studies or future scenario sets known to the participants. Therefore, the descriptions of the four future scenarios have to be clearly depicted and sufficiently insightful.

Scenario Set and Future Visions

The chosen framework results in the following four scenarios. The context has been sketched for each:

Individual – International: Individual Prosperity
Individuals seek after prosperity and luxury and work in casual relations for different clients. They deliver their contribution to global, virtual, shifting teams from their homes. They are not interested in the origin of products and services they consume as long as they are delivered right in time to their door and fully adjusted to their wishes.

Collective – International: Global Environmental Awareness
People live in cities. Tasks are highly divided; hence people are highly specialised in their profession. Services are the dominant work field. New technologies are maturing. Products and services are produced at the most suitable location. Government agencies worldwide have taken the lead for a healthy environment and manage the responsible use of natural resources. Companies make sure the economy runs smoothly.

Collective – Local: Strong Region
People have a regional network of acquaintances and social activities. Due to strict environmental policies, economic growth is no longer the predominant priority. Intensive reuse of natural resources and goods has restricted trade between regions. Society has shifted its focus from economic ownership to right of use. A region hosts most of the goods and facilities needed,

so people see no reason to leave the area, not even for a holiday.

Individual – Local: Self-sufficient Unit
A worldwide crisis has triggered a dramatic shift in society. It has brought about the development of highly self-sufficient small communities, which are organised according to the principle "cradle 2 cradle". Thanks to technological developments, habitats offer sufficient means of subsistence, and large global production flows belong to the past. Sharing knowledge globally is key to accomplishing this. Autarkic communities take up a lot of space relatively. This has resulted in ruralisation and a redevelopment of urban areas.

These scenario descriptions will be discussed by a mixed team of members from the Technological and Behavioural Vision Groups. They set the context for defining the transportation needs in each scenario and for possible (new and existing) modes of transportation to fulfil those needs. Future technological possibilities will be linked to (expected) societal issues as well as to solutions of problems. The consequences for society and its institutions, the profit sector, public sector and labour market will be analysed. Behavioural change is an ever-present aspect in all of these.

The Impact of Emerging Technologies

The participants have identified a wide range of (expected) possible technological developments. The ones believed to be most relevant to future transportation needs and possible modes of transportation are:

- Nanotechnology

- Biotechnology (nature as a source of inspiration, biological machines)

- Sensor technology

- Cognitive sciences

- Information technology (embedded systems, network technology, artificial intelligence, ambient intelligence, self-organising systems)

- Converging technologies

- Energy generation, storage and distribution

- Robotics

And to a lesser extent

- Genetic engineering

These expected technological developments will be used to translate future transportation needs into proposed transportation systems in each of the four scenarios.

Recurring and Remarkable Ideas: How Will a 'Cocoon Life' Affect Future Transport Options?

During the different meetings, some ideas have recurred. Others stood out based on their 'outside the box' character. A selection of these ideas is listed below.

Recurring societal ideas

- Self-organisation and self-help

- Self-determination (deliberate individual choices)

- Collectively individual (individuals enjoy their own choices together with others who made the same choice)

- Local/near-home production

- Need for social interaction remains

Recurring mobility ideas

- Underground transport (of goods and people)

- What you need comes to you, no need of collecting it

- Most favourable is to use what is already there

- Integration of activities and mobility

- Multi-modal transportation

- Non-travelling alternatives flourish

Remarkable ideas

- A cocoon to live in: you carry your home along with you and connect it to your location of work or recreation

- Relaxed and liveable city: above the ground back to nature; under the ground high-quality infrastructure

- Disposable transport

- Use of organic materials for transport (vehicles)

These ideas will be used to inspire and further develop the four future visions.

Assessment of Policy Options

The key issues for policy-making, the solutions required to tackle challenges and benefit from opportunities, the priorities and focus for action as well as critical factors and key players in shaping the future will be determined during the final part of this study.

### STT Netherlands Study Centre for Technology Trends

The Netherlands Study Centre for Technology Trends (STT) was established in 1968 by the Royal Institute of Engineers (KIVI NIRIA). STT explores new trends and develops inspiring foresights on technology and society. For this purpose, STT provides a free space for enthusiastic stakeholders to meet and construct creative views on the future. STT aims to give publicity to its findings as a contribution to a more integrated picture of the future of society in the Netherlands and elsewhere. The results serve as starting points for new

initiatives, such as national (applied) research programmes or public-private cooperation.

STT addresses industry, government, science and all other interested parties.

STT publications are highly valued in both the private and public sector.

STT Netherlands Study Centre for Technology Trends
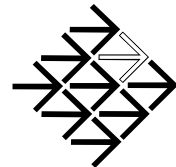
Sources and References

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STT organisation: www.stt.nl

Super Intelligent Transport Systems project page: www.stt.nl/transport

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