Editorial

The *ITF Transport Outlook 2019* presents scenarios for the future of transport for all sectors and modes until 2050. How will demand for transport develop over the next three decades? How will this affect transport CO_2 emissions? How could various disruptive developments affect transport? To what extent will transport's future resemble its past, and to what degree will it become something altogether different?

The level of uncertainty with regard to the future path of transport is striking in all its areas. Uncertainties surround the pace of economic development, global trade and the price of oil. Uncertainties abound regarding travel behaviour and mobility patterns as well as technological progress and innovations. The sheer multitude of variables and the enormous scope of increasingly fast-paced and disruptive change render the future of transport ever more difficult to foretell.

Past *ITF Transport Outlooks* have addressed "normal" uncertainty about the future. They offered scenarios in which the speed and direction of changes in transport would shift incrementally, not going as far as to considerer changes in the fundamental scope and structure of transport activity. This is a prudent starting point when transport as a social-technical system is generally mature and stable.

Yet sometimes disruptions trigger developments that foreshadow of a future radically different from a mere extension of the present. It is at these times that extrapolation as the default approach for thinking about the future becomes less helpful. As a trend emerges, humans tend to underestimate its importance for the future. Conversely, they overestimate the future significance of an already mature development. Even as forecasts no longer align with reality, we remain overly optimistic. For example, projections of road traffic volumes in many countries have far exceeded real road usage.

Transport has undergone several disruptions in the past 300 years – from animal traction to machine traction, from sail to powered navigation, from coal to liquid fossil fuels. Indeed, today's transport systems is the result of disruption (notably of the introduction of the combustion engine), and it is not unreasonable to believe that by 2050 fundamental changes in the way people have access to work, to services, to goods, leisure and each other will occur.

A main focus of this *Transport Outlook* is an attempt to assess the impact of potential and plausible disruptions to the transport sector – and to do so in a robust way by stress-testing assumptions at the core of the different scenarios. Describing the effects of a disruption that has occurred is relatively straightforward. Identifying a disruption in progress is a different and more ambiguous exercise. For the purposes of this study, disruption is defined as innovations which lead to entirely new ways of doing things – or allow the previously impossible to occur.

Disruptions can occur at different levels and various scales. Some only impact one product category – the introduction of synthetic rubber production and its effect on the

tyre industry or the uptake of mobile ticketing for public transport, for example. Others reshape an entire sector – such as centralised, computer-based ticketing for air travel or the arrival of app-based ride-sourcing for the taxi sector. Other disruptions still, though rare, have a broad impact across multiple sectors and areas of human activity – e.g. the mass production of cars and the resulting changes on travel behaviour, on urban development (and real estate markets), on opportunities and economic welfare in general. Another example is the introduction of the standardised shipping container and the significance this had for freight transport, hence trade, economic activity, and ultimately global income growth.

The analysis in this *Transport Outlook* centres on disruptions with the potential to entail broad and wide-spread changes to existing practices and areas of transport activity. Five core factors drive disruptive changes:

- *Cost*: new technologies and/or processes make old ones uncompetitive in terms of production costs – the new ones become so cheap that old ones become unprofitable.
- *Quality*: new technologies and/or processes raise the quality of products or services to a level that makes the old ones uncompetitive.
- *Customers*: significant changes in consumer or business customer preferences make previous products or services unattractive compared to new ones.
- *Regulation*: new laws or regulations no longer permit old ways of working – for example environmental or labour protection rules – or allow new ways of doing things that previously were not allowed.
- *Resources*: previously important resources are no longer readily available or previously inexistent or inaccessible resources now become available.

Disruptive trends typically emerge from a combination of these factors. For instance, a change in cost combined with an improvement in quality or the convenience of a technology or service may change consumer perception of value for money, which then motivates the adoption of a new good or service. Indeed, many disruptive technologies or services are not necessarily superior to existing ones but simply provide "good enough" functionality at a low cost.

Much of the discourse around innovation and disruption centres on technology because of the facilitating role the latter plays. But technology alone does not cause or sustain the types of radical changes it can trigger. Further, many disruptions are aided by the parallel emergence of multiple technologies and the services they facilitate. In this respect, disruptions can better be characterised as *disruptive developments,* which – in combination with other factors and under the right facilitating conditions – can lead to change that makes previous processes, services and/or products ineffective.

Transport today is a socio-technical ensemble that converges towards a central set of technologies and practices. These practices evolve together into a stable, self-reinforcing system. Innovations branch out at the margin of this central strand, but few gain enough traction to change the overall momentum and trajectory of the system. Under the right set of conditions a few innovations may gain hold, however. As innovators start to nudge the system away from its path, some incumbent firms, existing services or established behaviours are no longer viable. Some fail while others adapt and accompany the early disrupters – some in earnest, others to hedge their bets.

In periods of disruption, the historical system starts unbraiding itself and a patchwork of multiple, sometimes conflicting, socio-technical regimes emerges. This patchwork includes legislation and regulation, behaviours and activities, and technologies and services. The period of disruptive unbraiding and transitional re-weaving is characterised by high levels of uncertainty. Early disruptors still act in reference to the historic strand of the socio-technical system. But at some point during the transition new players appear that no longer reference the old set of actors, rules and practices. At this stage, convergence towards a new socio-technical regime sets in.

Clearly, there are developments within and outside of the transport sector today that are challenging the existing ways of doing things. The arrival of digital platforms that are giving rise to new mobility services, the change in shopping as a result of e-commerce and the (potential) decentralisation of production as a result of 3D printing may have a significant impact on passenger and freight transport.

But how much of an impact? The answer to that question partially lies in how public authorities position themselves vis-à-vis such developments. What rules do governments remove, which rules do they put into place? Which trends support political mandates, say, for more efficiency, increased sustainability, enhanced equity? And which disruptive developments might on the contrary undermine societal objectives?

The analysis presented here does not, and cannot, answer these questions directly, and the scenarios in this *Transport Outlook* should not be taken as forecasts for the coming 30 years. Rather, they describe several possible futures. Whether reality comes closer to one or the other will depend on how assumptions for the scenarios hold up, and also on the course of action policy makers will chose. What this study offers are plausible scenarios around future disruptions that can inform discussions about the role public policy can play in guiding and managing disruptive change.

From:

ITF Transport Outlook 2019

Access the complete publication at:

https://doi.org/10.1787/transp_outlook-en-2019-en

Please cite this chapter as:

International Transport Forum (2019), “Editorial”, in *ITF Transport Outlook 2019*, OECD Publishing, Paris.

DOI: https://doi.org/10.1787/e07cba49-en

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