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Unleashing the Potential

TRANSPORT AND INNOVATION: TOWARDS A VIEW ON THE ROLE OF PUBLIC POLICY

INTERNATIONAL TRANSPORT FORUM

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1. Introduction

The 2010 ITF meeting in Leipzig will address the general theme of transport and innovation. This note is one input to that meeting. It aims to provide some context on what innovation is in general and what policies may be needed, and uses these insights to work towards a view on innovation policy in the transport sector. The text draws on a variety of published sources. Documents emanating from the OECD Innovation Strategy are a particularly prominent source.

Section 2 discusses the concept of innovation. Whereas innovation traditionally was somewhat narrowly interpreted as mostly profit-driven entrepreneurial activity, it is increasingly seen as a strategic activity (serving explicit goals) in which a broad range of agents are involved. Section 3 is on policy justifications for and approaches to innovation policy. Policy is justified where there are market failures and system failures, and – parallel to the broadening view on what innovation is – views on policy needs tend to have broadened, although the awareness of the risk of policy failure has increased as well. Section 4 draws from the previous sections to formulate some tentative ideas on innovation policy for the transport sector(s).

2. The concept of innovation

Innovation includes the provision of new goods or services and new ways of supplying existing goods or services. The essence of innovation is improvement over current practice through the exploitation of advances in knowledge. Improvement can pertain to products, services, business models, marketing, and to general purpose technologies. Innovation is clearly a very broad concept, and while the definition may not be particularly helpful in identifying key policy issues, it invites a few observations:

- Innovation is much broader than R&D, including often less tangible involvement of businesses and consumers. A research-view of innovation is too narrow, as inventions are not costlessly absorbed in the market. “It takes a Schumpeter-type entrepreneur to solve the problems in developing and marketing an innovation. It takes Nelson-Phelps managers to solve the problem of evaluating the innovation’s likely gains [...]; it takes Amar Bhidé-type consumers to solve the problem of evaluating the gains [...] of bringing an innovation home; and it takes [...] financiers who can do better than choosing randomly in deciding which entrepreneurs to back.”[1] Maintaining a broad view and understanding various agents’ role helps design effective policy.

- Innovation is, by definition, about change and involves uncertainty[2] for innovators and non-innovators. When individuals and societies are risk-averse and less risky activities are easy to access, then innovative effort is discouraged even if the rewards in case of success are high. This view emphasizes that attitudes toward innovative activity depend on macroeconomic and social configurations, and that a balance should be struck between these configurations and innovation/growth objectives.

1. Phelps E., 2006, Macroeconomics for a modern economy, 2006 Nobel Prize lecture in economics, Nobel Foundation., p.15. Schumpeter-type entrepreneurs are willing to take on the risks associated with new products or techniques. A Nelson-Phelps manager develops the best possible knowledge to evaluate the likely outcomes of innovations. Amar Bhidé consumers have the capacity to assess benefits of new products which increases the likelihood of good innovations being adopted. Knowledge and education are an important prerequisite for these types of agents to emerge.

2. Uncertainty refers to outcomes about which nothing can be learned from observation of past events.

- Innovation delivers improvement, but compared to what? The traditional view of innovation emphasizes economic productivity and growth[3], but debates increasingly focus on strategic goals, notably sustainability and well-being. The latter imply a need for policy interventions to give the process a direction: innovation should be *harnessed* for more sustainable growth (*cf. e.g.* the OECD Innovation Strategy). Consequently, when society's capacity for innovation is fixed or not very elastic, no discussion of innovation and innovation policy is possible without a view on policy priorities and accepting tradeoffs.

- The benefits of innovation are measured in terms of their societal impact, not in terms of private and public inputs. But given the broad and opaque nature of innovation, such measurement is very difficult, so that ex-post evaluations of innovation efforts and innovation policies are few and far between. More generally, measuring innovation efforts and results poses a major challenge.

3. Innovation policy

Policy rationales

Policies to stimulate innovation in general are justified when there is not enough innovation without policy. Policies to steer innovation are justified when the innovation that there is does not serve goals deemed appropriate. The current view is that both policy stimulus and policy steering are needed (OECD, 2010, chapter 7).

The need for stimulus results from market failure and from system failure. Market failure is a well-known concept. In the context of innovation, indivisibilities, uncertainty with information asymmetry, and externalities are the main causes of underprovision of innovative effort in markets. Systemic failure is a broader concept, related to the broad view on innovation emphasized above. It includes mismatches between the different components of the innovation system, information failures, incompatible incentives, and other factors that prevent smooth operation of the system. Where such failures occur, policy is justified in principle. However, since policy is imperfect and costly, a case needs to be made that policy interventions are worth it in balance.

The need for steering results from the view that markets do not steer economic development in the direction desired by policy, e.g. development may not be seen as sustainable. Steering innovation is clearly required when external effects, e.g. related to pollution and climate change, are not dealt with by proper policies. However, steering is sometimes thought to be needed also when such policies do exist, given the perception that markets are not capable of producing transformative innovation in the desired direction. Fairly strong policy interference with innovation, and with development, then is seen as justified. While this view goes further with classical views on innovation policy, which focus more on providing framework conditions allowing innovation efforts to thrive, it shares common features with industrial policies of the type pursued in some successful emerging economies.

Policy principles for stimulating innovation

Innovation is the main source of productivity growth in advanced economies. For innovation to be attractive, product, labor, and capital markets need to work well, i.e. constraints on entry and exit ought to be limited. More in general, clear and reliable framework conditions are needed. Prevailing conditions are not always ideal. For example, strong social protection may inhibit the functioning of the labor market, and it is sometimes judged that the price to pay in

3. The test for success is the market, *i.e.* innovation is geared towards satisfying consumer preferences.

terms of less innovation is too high.[4] This is not to say that social protection is necessarily detrimental to innovation, just that it needs to be carefully designed to be compatible with strong incentives for innovation.

Apart from framework conditions, policies to mitigate innovation-related market and system failures are satisfied as well. For example, given the public good nature of knowledge, basic R&D to expand knowledge needs to be subsidized. Further policies are needed, but depend strongly on particular circumstances which vary strongly between countries, sectors, and firms. OECD (2010) provides an overview of what policies are likely to help or fail in particular situations.

Empirical research for the World Economic Forum reveals that a country or region's economic development initially is mainly factor-driven, then becomes efficiency-driven, and then becomes largely dependent on innovation. Institutions need to be adapted to the particular stage of development. For example, the Aho report[5] warns that Europe needs "more innovation friendly markets", "more resources for innovation", and "more mobility" or "it will fall behind". Market unification should be strengthened through harmonised regulation, also for patents. Standards should be strict and prompt. Public procurement should be used more to drive innovation, meaning a shift away from an emphasis on the lowest cost at the time of purchase. Using public procurement for innovation purposes should be done carefully, e.g. avoiding misuse for protectionist purposes.

Focussing on innovation has implications for labour markets. Many jobs in an innovation-oriented economy involve unique and difficult-to-transfer knowledge, and this calls for complex forms of collaboration. Workers need considerable training, and organizational forms should allow for responsibility and discretion. Workers also should be able to move between jobs fairly easily.

Publicly executed or financed research should cross ministry lines, and academic research needs to be given clear direction. Innovation has become more collaborative, taking place in networks and leading to knowledge markets (UNEP, 2009). For such markets to work well, intellectual property rights are a prerequisite.

Adaptation of institutions and policies to accommodate new forms of innovation takes many forms. For example, tax credits are likely to be preferable over direct subsidies as they are less connected to specific projects, but they are less suited towards steering innovation. Facilitating firm entry and exit helps as well, as frontier-innovation generates "turbulence".[6] Harmonisation of regulations may hamper such facilitation, if it is harmonisation around prevailing types of regulation. Other factors include good intellectual property protection, low interest rates, access to risk-capital for start-ups, and more flexible labour markets.

A key policy issue for innovation as a growth engine is to strike a balance between incentives for innovation (through patents, IPR, or other means of protecting profits from innovative effort) and competition. In many circumstances, competition helps us make the best

4. The Sapir Report posits that, starting roughly in the 1980s, innovation at the frontier has replaced incremental innovation (imitation) as the main engine of growth. Post-war growth in Europe was fast and could be combined with strong social protection as long as Europe was catching up with the US. But Europe's organisational forms (large firms exploiting scale economies, with large R&D labs funded through direct subsidies often around prestige projects; little labour mobility, etc.) are not well suited for pushing the technological frontier. R&D of the latter type tends to be more decentralized, taking place in small firms and universities. Adaptation to these circumstances is crucial for Europe to escape from its sluggish growth pattern.

5. http://ec.europa.eu/invest-in-research/action/2006_ahogroup_en.htm.

6. From 1950 through 1970, turnover in the Fortune 500 was 30%. The same rate was reached between 1970 and 1980, in the 1980s it took 5 years, and in the 1990s 3 years. Stability is larger among the largest firms (p.35).

of available resources and technologies, making it desirable from a static point of view. However, from a dynamic perspective, unfettered competition may hamper innovation because it limits entrepreneurs' power to capture the benefits from their innovative effort. Temporary monopoly power then can be a useful device for stimulating innovation. This view, however, has been strongly challenged on various grounds.[7] First, property rights on ideas could slow down their dissemination (although patents can come with an obligation to diffuse through a patent office). Second, once monopoly power has been created, the monopolist has little interest in pursuing further innovation and may use market power to make competitors' lives more difficult. The net effect of property rights on overall innovative effort could go either way, and the costs in terms of reduced competition may be large. Third, proliferation of patents or other forms of property rights may discourage innovative efforts, as the probability that such effort produces results already protected by patents increases ("patent thickets"). In short, the modern view does not deny that rewarding innovators for their effort stimulates innovation, but warns that strong protection can easily carry high costs through second-order effects.

On the related question on the dependence of innovative effort on market structure, the emerging view is that of an inverted U-shape: strong market power (e.g. a monopoly) tends to be associated with little innovative effort, effort first rises as competition increases, and then declines again as competition becomes more intense (OED, 2010)[8]. If innovative effort is to be stimulated, some degree of market power is required. Competition policy is the tool of choice to avoid abuse of such market power.

Policy principles for steering innovation

Since the entrepreneurial behaviour driving innovation is usually for profit, current economic systems mainly stimulate commercial innovations. Innovation to support the attainment of non-marketable goods requires policy interventions that commercial innovations don't. One necessary policy intervention consists of providing market signals ("internalizing externalities", "getting the prices right") for goods that the market fails to produce when left to itself. Whether this is a sufficient intervention is not clear and often doubted. If a policy goal is held to be of overriding importance, more needs to be done than just providing the best possible market signals. But more policy involvement is not without problems and extremes such as "picking winners" are to be avoided (although insisting that policy should be entirely neutral is not feasible either).

Sustainable economic development is high on the political agenda. The environmental and potential climate impact of current economic activity is deemed excessive, and action to reduce it is underway or at least under consideration. Reducing the environmental impact of economic activity can be done by changing the nature of that activity or by adopting technologies that mitigate its impact. The relative importance of both strategies depends on the problem at hand, but technological change is perceived as a key component of environmental policy in many sectors, including transport. This holds a fortiori where climate change is concerned.[9] Innovation, understood as improvement over current practice, is a key component of moving towards sustainable development.

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7. *C.f. e.g.* Sitglitz J.E., 2009, Intellectual-property rights and wrongs, www.project-syndicate.org/commentary/stiglitz61.

8. The view is emerging and is based on evidence on R&D expenditures, which are a partial and imperfect indicator of innovation effort.

9. *E.g.* Van Dender K., 2009, Energy policy in transport and transport policy, Energy Policy, forthcoming. In private passenger transport, electric vehicles are currently seen as the way forward by some. Given current and foreseeable battery technology, it is far from clear, however, that they will be able to provide the same service as conventional vehicles. So other technologies or behavioural adaptations, or a more modest abatement goal, may be required.

Questions on how to stimulate technological change, if necessary at all, have been studied in some detail in environmental economics.[10] Use of the apparatus of standard neo-classical economics tends to lead to a quite narrow view on innovation, with a *focus on the adoption of existing technologies*[11] and little attention for the dynamics of the process and the broad range of actors involved in getting innovations to the market. Of course, there are useful insights, of which some general ones are:

- Technological change itself is characterized by market failures, so policies that focus on correcting environmental market failures alone are not sufficient, and a technology or innovation policy is required. But technology policy is not a substitute for environmental policy.

- Among policies to stimulate the take-up of new technologies a distinction can be made between "demand-pull" measures (feed-in tariffs[12], supplier obligations, public procurement, standards and regulations) and "supply push" measures (grants, capital grants, prizes, matched equity funding). Demand-side measures help establish a long-term demand framework that incorporates environmental costs. However, such demand-side policies should not be expected to induce a lot of additional R&D expenditures, particularly where climate change is concerned. This holds a fortiori for policies that aim to "get the prices right". Demand-side measures are particularly ineffective when introduced in small markets (countries). Supply-side policies have a more direct impact on firms' innovative efforts.[13]

- The costs and benefits of technologies depend on how widely they are used. Consumers "learn-by-using", *i.e.* knowledge is generated while technologies are gradually being adopted and this is a positive spillover.[14] On the producer side the analogue is "learning-by-doing". Network externalities occur when increased adoption increases the value of a product (*e.g.* you can phone more people as more people have phone).[15]

10. For a detailed survey, see Jaffe A., R. Newell, and R. Stavins, 2003, Technological change and the environment, in: K.-G. Mäler and J. Vincent, Handbook of Environmental Economics – volume 1, Elsevier Science. A shorter overview by the same authors: Jaffe A., R. Newell, and R. Stavins, 2005, A tale of two market failures: technology and environmental policy, Ecological Economics, 54, 2-3, 164-174.

11. Although interpretations implicitly address a wide range of technologies, strictly speaking only end-of-pipe technologies, which have no alternative use but reducing emissions of a given production technology, are covered by this literature (Bauman Y., M. Lee, and K. Seeley, 2008, Does technological innovation really reduce marginal abatement costs? Some theory, algebraic evidence, and policy implications, Environmental and resource economics, 40, 507-527). The reason is that a non-end-of-pipe technological innovation, *e.g.* better fuel efficiency, has many potential uses, so that an application to reduce emissions has opportunity costs that may translate into increased marginal abatement costs. The point is related to remarks about improved engine technology: the market prefers its deployment for improved performance as long as fuel costs are not too high.

12. Feed-in tariffs are deployment subsidies for a particular technology, and may make sense as long as market prices do not match policy aspirations (as arguably is the case for CO_2-abatement).

13. See for example the evidence discussed in OECD, 2009 (COM/ENV/EPOC/CTPA/CFA(2009)37 and Frontier Economics, 2009, Alternative policies for promoting low carbon innovation – Report for Department of Energy and Climate Change, Frontier Economics, London, and the discussion in JTRC, 2008, The cost and effectiveness of policies to reduce vehicle emissions, JTRC Discussion Paper, 2008-9.

14. Gradual adoption can also occur because of consumer heterogeneity, in which case no externality is involved.

15. The provision of service and maintenance networks for alternative vehicle technologies can be seen as an extreme case of a network externality: such networks increase the value of such technologies but will only be provided if adoption is widespread; however, the absence of such networks slows down adoption.

- Returns to R&D spending are highly uncertain and firms can assess the risks better than investors. This information asymmetry makes it hard for R&D firms to attract funding, as potential investors cannot distinguish between low- and high-risk firms. Large firms therefore have an edge, with larger potential to self-finance.

- Principal-agent problems can hamper the adoption of innovative technologies. One example is where home-owners decide on investments in energy-efficiency but tenants pay energy bills. If tenants are poorly informed about the benefits of investment, owners may underinvest.[16]

Ex post evaluations of policy to stimulate research, development and innovation are scarce. The insights of two ex-post studies (NRC, 2001 and Faugert *et al.*, 2009[17]) on policy initiatives are relevant to the transport sector. The studies find that, while quantifying benefits is difficult in principle and keeping track of costs is not done in sufficient detail in practice, government support for R&D is thought to produce net benefits. The following recommendations are made to increase benefits:

- Benefit assessment should take account of policy goals. If policy emphasizes objectives not well served by markets (*e.g.* environmental goals, sustainability), then over-reliance on market benefits should be avoided. This is straightforward as such. However, project managers tend to emphasize marketable results because they are more tangible and often quicker to materialize.

- While R&D programs generate benefits, there is considerable variance in the results of individual projects, and some projects fail. Such variation is normal: if no projects fail, the portfolio of projects likely is too conservative. A well-diversified portfolio contains exploratory, applied, and demonstration projects, with differing time horizons and a range of technologies. It does not follow that public support should be distributed at random, as the expected leverage of public funding varies with projects. For example, the marginal product of public support is likely to be relatively large in fragmented and less profitable sectors (including segments of the transport sector), where incentives for private effort are weak.

- Projects where public and private partners share costs tend to outperform others. Sweden's Vehicle Research Programme consisted of public funds with corporate co-financing, where companies apply for support (allowing them to define priorities, while maintaining alignment with public priorities) and the research is done in collaboration with universities. The result is a partnership between the parties involved and a system-change in the innovative culture of the industry.[18] The program improved Swedish manufacturers' competitiveness.

16. Similar problems occur in the company car market.

17. NRC (National Research Council), Committee on Benefits of DOE R&D on Energy Efficiency and Fossil Energy, Commission on Engineering and Technical Systems, 2001, Energy Research at DOE: Was it worth it? Energy Efficiency and Fossil Energy Research 1978 – 200, National Research Council. Faugert S., E. Arnold, M-L. Eriksson, T. Jansson, P. Mattson, L. Niklasson, P. Salino, H. Segerpalm, and T. Aström, 2009, Summary – Impact of Government Support to Automotive Research, Vinnova Analysis 2009 – 12.

18. Absorption of innovative capacity requires sufficient scale, so is harder to attain in more fragmented industries and smaller firms.

- Forced introduction of specific technologies usually does not work. However, "the importance of standards pulling technological innovation [...] cannot be exaggerated". (NRC, 2001, 6). In other words, successful innovation and diffusion policy requires complementary measures to stimulate the widespread adoption of R&D outputs. This holds a fortiori where goals not well served by markets are concerned.

4. Innovation and innovation policy in transport

Transport contributes to economic growth. It is also widely held that its further development should be geared to take better account of sustainability and well-being. Intermediate goals for the transport sector include productivity improvements (pushing the production possibility frontier), more efficiency (operating closer to the production possibility frontier), safety, security, and environmental impacts including climate change. Issues regarding the contributions of transport to economic growth include decisions on infrastructure provision and on adequate (*i.e.* sufficient, reliable, and efficient) funding.

Innovation has a role to play in all these objectives. In some cases, *e.g.* productivity improvement, innovation is more of the commercial type and policy is mostly about creating possibilities for entrepreneurs to increase profits through innovation, i.e. stimulating innovation. Often, in such a context there will be complaints about excessive regulation that stifles innovation, and there is substantial evidence that deregulation has been beneficial in a number of areas, amongst other because it facilitated innovation. By the same argument, private sector calls for public support or for regulation to support innovation need to be scrutinized on their potential to affect particular types of innovation and to stifle competition.

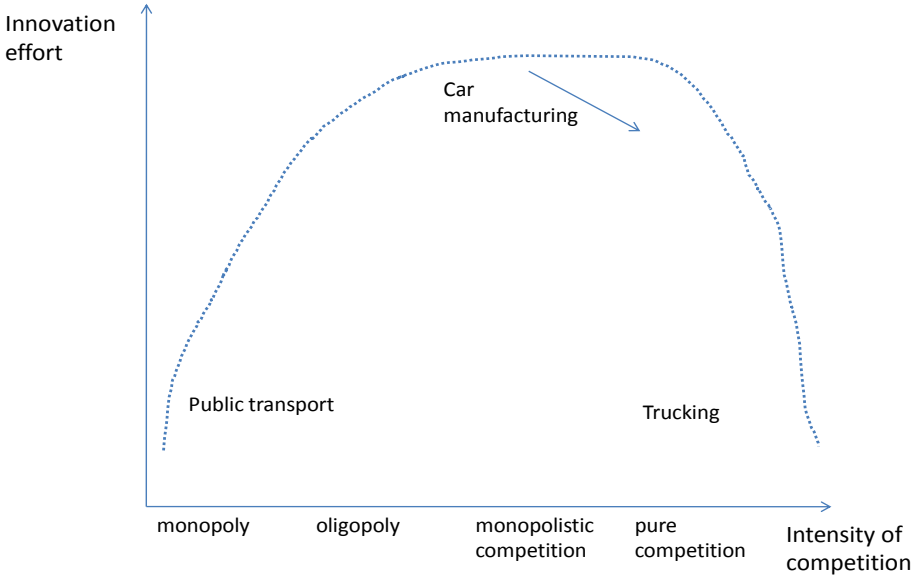
For a number of policy objectives, arguably the majority, transport policy aims to repair shortcomings of the market. In these cases, transport innovation policy is about guiding innovative processes in a particular direction (steering innovation), and not just about creating the best possible conditions for entrepreneurs to pursue profits through innovation. Among these "interventionist" objectives, one can distinguish between incremental innovation (efficiency, safety, security, conventional environmental impacts) and transformative innovation (decarbonisation, possibly funding mechanisms). With the latter, uncertainty is a key concern in two respects: (1) any business case for innovative effort rests on a credible policy commitment, and (2) policy-makers may want to reduce uncertainty on whether goals are reached to the largest possible extent.

It is clear that there are substantial differences among the policy goals about what they imply about innovation and innovation policy. In addition, the transport sector is not homogenous. It therefore is not straightforward to draw general conclusions on "innovation in transport". But the framework developed in Sections 2 and 3 provide guidance. The following paragraphs discuss some examples.

Market structure and innovation in transport

The relation between the intensity of competition in a market and incentives for innovation is plausibly described by an inverse U, see Figure 1. This stylized fact helps us get a grip on the incentives for innovation in subsectors of the very heterogeneous transport sector. Some examples are indicated in the figure. Competition in trucking is intense. Low entry and exit barriers result in many small firms operating at small margins, resulting in limited capacity to cover fixed costs and finance innovation. At the other end, competition in some segments of public transport remains very limited. Despite efforts to create competition in or for some markets, near-monopoly situations remain. Here too, little innovation should be expected, simply because a monopolist has no need to innovate.

Figure 1. **Market structure and innovation effort**



The automobile industry is an intermediate case. It can be described as an oligopoly or a monopolistically competitive industry, with the latter label increasingly apt as cars become more and more commoditized. This means there should be relatively strong innovation efforts in the industry, and this is consistent with observation. However, this innovation will respond to consumer demand, and is not necessarily in line with sustainability objectives. This is discussed in the next subsection. Other examples of intermediate cases in transport include supply chain operations including railways. In line with the observation made above, the need for alertness of competition law authorities as a key factor to maintaining a balance between advantages from scale (a.o. for innovation) and disadvantages from market power, was emphasized in the JTRC round table on vertical integration. It deserves mentioning that integration, scale increases, and the emergence of innovative services have gone hand in hand in the supply chain industry.[19]

Steering innovation – the example of low carbon technologies

According to the framework just described, the car manufacturing industry has both the capacity and the incentive to put considerable effort into innovation. However, this effort of course is focussed on increasing profits, whereas there is a strong policy thrust towards making cars more sustainable, in particular regarding their fossil fuel intensity. This is a case study on how to steer innovation, studied at a recent JTRC round table.

Experts agree widely that carbon prices are a prerequisite for successful decarbonisation of the sector. Regulations, e.g. fuel economy standards, area more costly than charges when they reduce flexibility in responses. However, standards are seen as a necessary component of policies that don't just aim to reduce fossil fuel consumption in transport, but rather aim to change its principal source of energy. Standards are a complement to prices. Higher carbon prices reduce the demand for carbon-intensive energy, and stricter standards reduce the supply of carbon-intensive vehicles. Together they send a strong signal. Standards provide certainty to producers on what fuel economy to reach. This helps create a favourable investment climate, especially when long term goals can be announced with sufficient credibility. The importance of the need for credible government commitment to policy goals cannot be overstated in this context.

19. In this context it is noted that the container was one element, but the business model for deploying it was more important.

A preference for standards could be seen as a preference for attaining greenhouse gas abatement through technology rather than through reducing demand. One reason for this could be that maintaining transport demand protects existing markets and those supplying to them. A less cynical view is that technology-based approaches are emphasized because they are less uncertain than more demand-oriented strategies. Transport energy policies that rely on prices and standards are compatible with policies to manage transport demand where these are necessary, for example in relation to congestion.

Consumer involvement and acceptance – the example of congestion charging

Congestion in urban areas causes serious excessive costs. Transport economists have long lamented the lack of policy interest for a tool that to them is so obviously welfare-improving as congestion charges. However, what is obvious in principle is less obvious in practice. Questions regarding the desirability and feasibility of congestion charges become apparent when policy constraints and policy costs are taken into account. How to convince voters and their representatives that making travel more expensive when traffic is bad, is a good idea? How to set charges and deploy revenues so that the distribution of gains and losses constitutes a marketable political proposition?

Acceptance is seen to be the conditio sine qua non for successful implementation. Acceptance can be managed to some extent and depends on factors other than reduced congestion. There can be some trade-off between perceived and assessed benefits of charges. The extent to which such trade-offs are made should not, however, be allowed to undermine the core objective of charges – which is to cut congestion. Ancillary benefits, including reduced environmental impacts, can in some cases have an impact on how much to charge and should always be included in assessments, but they are not the principal goal of congestion charging mechanisms. Early involvement of stakeholders is essential for making congestion charges acceptable and it helps keep costs down as risk aversion is mitigated, allowing cheaper design.

Innovative funding

Somewhat related to the debate on congestion charging, discussions on whether it is opportune or possible to continue relying on energy as the main tax base for transport are becoming more prevalent. In some countries, proposals to move to usage-based funding are on the policy agenda. Such a switch of course would be a major innovation, but it too is seen to be very hard to sell to voters.

Deregulation releases innovation – the example of aviation

The transport sector provides several examples of how the removal of regulation can induce major innovation efforts. Aviation is a notable example. Deregulation in the US in 1978 was expected to bring substantial consumer benefits through reduced fares, which would boost demand. These changes indeed did occur. Other changes were not expected and are now seen as major innovations that transformed the industry. Hub-and-spoke networks and yield-management systems emerged soon after deregulation and brought (mainly) benefits. Low cost carriers emerged somewhat later, and are a textbook example of how new business models can expand markets and stimulate competition. Online reservation systems also intensified competition. Deregulation of the industry spreads slowly across the globe, although restrictions remain in some markets.

5. Concluding remarks

This note proposes a view on what innovation is, and what policies are needed and possible to stimulate or steer it where necessary. For this it relies on existing documents, notably the OECD Innovation Strategy. It then attempts to apply this view to the transport sector. Since innovation is a very broad process and the transport sector is very diverse, no attempt was made to make overarching statements. The various features of the broad process of innovation and the need for and design of innovation policies are all present in segments of the transport sector. The analytical principles underlying the OECD Innovation Strategy and its the policy recommendations find applications in transport.

As a final remark, it is reasonable to argue that the need for steering innovation is more present in debates on innovation for transport than it is in the general discussion of the OECD Innovation Strategy. This is mostly a matter of emphasis, but nevertheless a focus on steering leads one to highlight particular issues. For example, neutrality (not picking winners) becomes harder to attain when particular goals need to be met (within a particular time frame). The relevance of these differences in emphasis becomes stronger when transformative instead of incremental innovation is envisaged.

