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Review of the implementation of the 2030 Agenda for Sustainable Development in Asia and the Pacific: transport

Sustainable transport as an engine for greater empowerment, inclusiveness and equality in Asia and the Pacific

Note by the secretariat

Summary

Building on the mandate of the Economic and Social Commission for Asia and the Pacific (ESCAP) to promote sustainable transport connectivity in Asia and the Pacific, the present document contains an overview of the traditional and emerging policy considerations linked to transport connectivity as a driver of economic development, as a key sector for environmental performance and as an engine for social development.

As such, the document highlights the role of transport connectivity in empowering people and ensuring inclusiveness and equality in Asia and the Pacific. The information contained in the document provides a basis for discussion on formulating considerations on how ESCAP interventions and policy dialogue can enhance the links between transport connectivity and social development goals.

The Commission may wish to review the document and consider taking the following actions: (a) calling on the secretariat to scale up its activities in support of a greater integration of the social aspects of regional transport connectivity within the scope of its current mandate; and (b) providing additional guidance on raising the profile of the social aspects of transport development, particularly in the consideration of the second phase of the Regional Action Programme for Sustainable Transport Connectivity in Asia and the Pacific.

I. Introduction

1. Transport connectivity has a crucial role to play in empowering people and ensuring inclusiveness and equality in Asia and the Pacific. The availability of reliable transport infrastructure and services that enable people and goods to reach a range of destinations at reasonable costs and within reasonable time frames is essential not only for economic growth but also for a balanced distribution of economic and social benefits, while ensuring a proper management of the environmental impact of human development.

* ESCAP/75/L.1.

2. At the global level, United Nations initiatives, such as the High-level Advisory Group on Sustainable Transport, the first Global Conference on Sustainable Transport in 2016 and Sustainable Mobility for All initiative, have helped raise awareness of the contribution of sustainable transport towards achieving most of the Sustainable Development Goals. In the region, the regional policy dialogues and forums of the Economic and Social Commission for Asia and the Pacific (ESCAP) have identified transport connectivity as one of the key action areas for achieving the objectives of sustainable development. Regional transport connectivity is an integral part of the regional road map for implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific (Commission resolution 73/9). The Ministerial Conference on Transport, held in Moscow in December 2016, also stressed the key role of transport in implementing the 2030 Agenda for Sustainable Development and adopted the Ministerial Declaration on Sustainable Transport Connectivity in Asia and the Pacific (E/ESCAP/MCT(3)/11), which includes the Regional Action Programme for Sustainable Transport Connectivity in Asia and the Pacific, phase I (2017–2021).

3. As the global and regional policy debates have moved from establishing the link between transport and the Sustainable Development Goals to analysing how and under which conditions the transport sector can enable the goals to be realized, there is a need to reassess traditional transport policies and actions.

4. This involves the social dimensions of transport connectivity in particular. In most developing economies, traditional transport policies focus on the economic impact of transport connectivity with the aim of influencing trade flows and, to some extent, facilitating industrialization and the structural transformation of the economy. Increasingly, the aim of such policies is to address the issues of negative environmental externalities, and policymakers may assume that enhanced transport connectivity contributes to greater social development by, for instance, connecting people to a wider range of services and opportunities. However, empirical evidence has shown that increasing the provision of infrastructure or reducing transport costs does not always guarantee a significant impact on poverty reduction or an increase in equality. On the contrary, persistent, if not increasing, levels of inequality and social gaps can be linked in part to transport systems and policies which reflect the distribution of economic and social power in today's societies.

5. Achieving greater empowerment of people and improvements in the levels of inclusiveness and equality, therefore, requires reassessing and expanding the existing policy tools and providing a clear road map to make sure that transport policies and programmes effectively contribute to the social development agenda in Asia and the Pacific.

6. In line with these considerations, the present document provides an overview of the traditional and emerging policy considerations linked to transport connectivity as a driver of economic development and a key factor for environmental performance (section II). It also provides a wider perspective on transport and social development (section III) in order to formulate considerations on how ESCAP interventions and policy dialogue can enhance the links between transport connectivity and the goals of greater empowerment, inclusiveness and equality in Asia and the Pacific (section IV).

II. Transport connectivity in Asia and the Pacific: traditional driving forces and policy considerations

7. As a derived demand, the transport sector is linked to spatial, economic, and social transformations and takes on the complex and evolving nature of society. At the same time, the main considerations in transport policies continue to revolve around the link between transport and economic growth, extrapolating future transport needs based on the changes in the volume, structure and directions of freight and passenger flows, driven by trends in population growth and economic development, such as sustained economic growth and changes in the geography of trade. Some demographic trends, particularly urbanization, have been incorporated into traditional transport planning. Moreover, transport policies are gradually being placed in the context of climate change concerns, which calls upon transport to scale up its contribution to mitigation strategies. Finally, technological developments and innovation are a constant part of policy discussions that seek to understand and, if possible, anticipate their impact on the demand and supply of transport services.

A. Transport and economic development

8. Most transport demand assessments and forecasts are generated based on the historically observed correlation between economic growth and the increase in the volume of passenger and freight transport. Although it may be possible to decouple economic growth from the increase in freight and passenger transport,[1] in the case of developing countries, economic activity and trade are expected to continue to drive transport demand. These considerations are linked to projected population growth and the gradual income convergence between regions and countries. As economic and trade growth are expected to continue, albeit at a slower pace and at diverging rates depending on the region, the volume of transported goods and passengers is expected to keep increasing.

9. It is generally believed that Asia will face substantial increases in trade shares and, thus, freight volumes, owing to rapid population and economic growth. The global population reached an estimated 7.5 billion people in December 2017[2] and is expected to keep growing. Asia has witnessed a rapid population growth accounting for 60 per cent of the current world population, while the region only covers 30 per cent of the world's land mass.[3] The number of people in Asia is projected to keep rising, reaching an estimated 5.3 billion in the year 2050.[4]

10. Accordingly, some estimates suggest that in Asia, ton-kilometres of surface freight will increase by a factor of 3.2 from 2015 to 2050 accounting for over two thirds of all surface freight globally (see figure I). Increasing trade is also expected to increase the volume of intraregional freight flows by road and rail within continents. The highest growth will occur in Asia, followed by Africa, in line with the projections for gross domestic product (GDP).

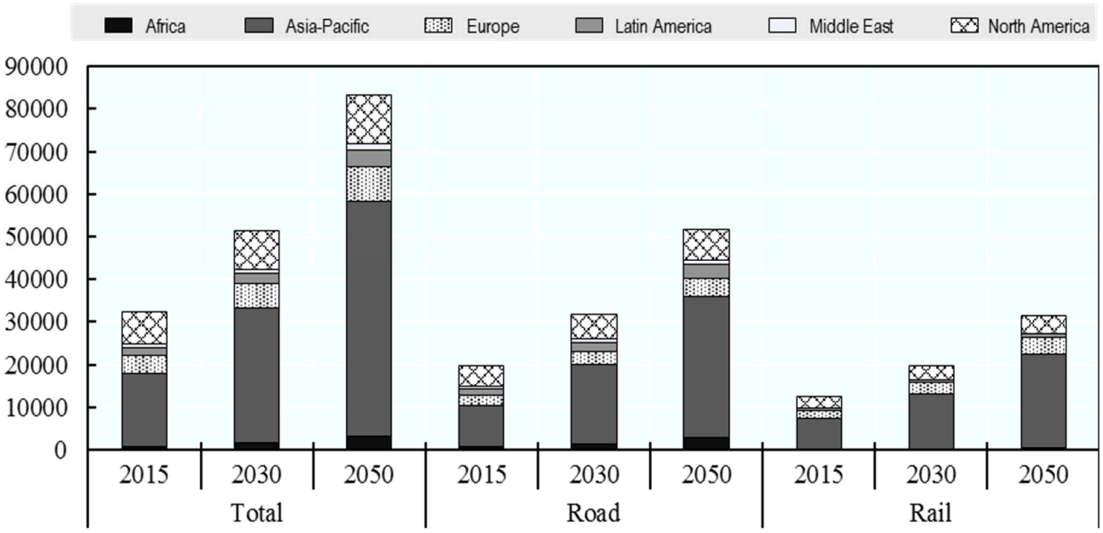
[1] Organization for Economic Cooperation and Development (OECD), Decoupling the Environmental Impacts of Transport from Economic Growth (Paris, 2006).

[2] World Bank, "Population, total". Available at https://data.worldbank.org/indicator/SP.POP.TOTL (accessed on 17 January 2019).

[3] World Population Review, "Asia population 2019", 6 December 2018.

[4] Population Reference Bureau, "2018 world population data sheet with a special focus on changing age structures" (Washington, D.C., 2018).

Figure I
Surface freight, ton-kilometres by region, baseline scenario



Source: OECD/International Transport Forum, *ITF Transport Outlook 2017* (Paris, 2017).

11. In line with this vision of transport connectivity as an enabler of international trade, countries of the region, with the support and technical assistance of ESCAP, have defined and formalized the Asian Highway and Trans-Asian Railway networks as two regional transport assets that were able to accommodate increasing volumes of international trade on mostly existing infrastructure. The Asian Highway and Trans-Asian Railway comprise 143,000 kilometres of highways in 32 countries[5] and 118,000 kilometres of railway lines in 28 countries.[6] The networks should conform with the respective flexibly defined minimum technical specifications and operational standards stipulated in the Intergovernmental Agreement on the Asian Highway Network and the Intergovernmental Agreement on the Trans-Asian Railway Network. In addition, the identification of a set of dry ports of international importance under the Intergovernmental Agreement on Dry Ports[7] has increased the operational efficiency of the two networks, extended their outreach to wider areas and facilitated their integration with the region's main maritime ports and other modes.

12. This collective effort has gone a long way towards aggregating disparate infrastructure systems into a common regional intermodal network to serve the region's economic integration, support economic growth and facilitate the exchange of goods and services.

13. Despite this progress, levels of logistics and transport performance remain relatively low in many Asian and Pacific countries, adversely affecting their economic development. ESCAP estimates that the infrastructure gap in the Asia-Pacific region requires a total investment of $128 billion to upgrade the regional transport systems and construct missing links identified in the rail,

[5] For a map of the Asian Highway network, see www.unescap.org/sites/default/files/AH-map_2018-2.pdf.

[6] For a map of the Trans-Asian Railway network, see www.unescap.org/sites/default/files/TAR%20map_1Nov2016.pdf.

[7] For extensive information on the background and status of the Intergovernmental Agreement on Dry Ports, see document ESCAP/CTR/2018/4.

road and intermodal network, including $75 billion for the Trans-Asian Railway, $51 billion for Asian Highway projects and $2 billion for dry ports. Moreover, despite improvements in infrastructure provision and quality, various operational challenges, especially on international transport connectivity, remain. As concerns international road transport, some countries still do not grant traffic rights to foreign road freight vehicles while others restrict the numbers of road permits issued to foreign vehicles. In addition, the lack of harmonized standards on vehicle weights, dimensions and emissions as well as mismatched and varying border crossing procedures and other requirements are all an impediment to seamless international road connectivity in the region. Similarly, missing infrastructure links and the lack of harmonized technical standards within the railway sector also adversely affect the efficiency and effectiveness of international railway operations among ESCAP member States.

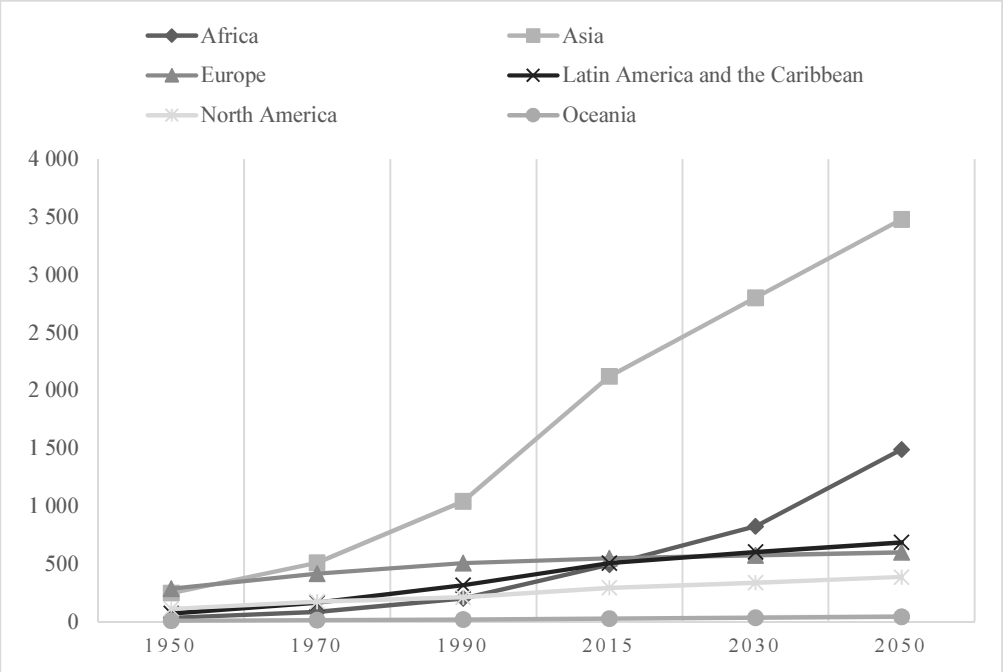
14. Against this background, ESCAP has been actively engaging in identifying areas for regional actions aimed at addressing infrastructure requirements, capacity bottlenecks and institutional issues that negatively affect the costs and delays of international transport in the region. As part of these activities, ESCAP conducted studies on the simplification of documentation, and the deployment and use of information technology for rail-based intermodal transport services. Further to this, ESCAP has also published the *Handbook on Cross-Border Transport along the Asian Highway Network*, which provides information on the overall status of border crossing conditions along the entire network. In addition, a study was conducted in 2017, exploring the potential for developing rail corridors connecting Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan. In late 2018 ESCAP turned its attention to addressing rail connectivity gaps from China to the Caucasus via Central Asia and conducted a targeted capacity-building seminar with a view to identifying concrete steps forward. ESCAP is also implementing a project to support the development of dry ports in Cambodia, the Lao People's Democratic Republic, Thailand and Viet Nam, helping countries gain synergies from inland dry port to seaport connectivity by rail transport.

15. In short, concerns related to infrastructure development, especially in the context of growing demand for freight and passenger transport, continue to dominate the transport policy agenda in Asia and the Pacific, and therefore they remain a high priority of ESCAP activities.

B. Transport and urbanization trends

16. Capacity concerns also arise with respect to passenger transport, especially in the urban context. Urbanization is increasing, especially in Asia and Africa (see figure II). The rate of urbanization, especially in developing countries, is already compromising the efficiency of transport in cities, despite urbanization being considered a key factor for transport policy development for several decades already. In 2018, 55 per cent of the world's population was concentrated in cities (see figure III), a proportion that is expected to increase to 68 per cent by 2050, according to the Population Division of the United Nations Department for Economic and Social Affairs. In Asia, the urban population is nearing 50 per cent, even though the continent remains the home to the world's largest rural population.

Figure II
Urban population by region, 1950–2050
(Millions)

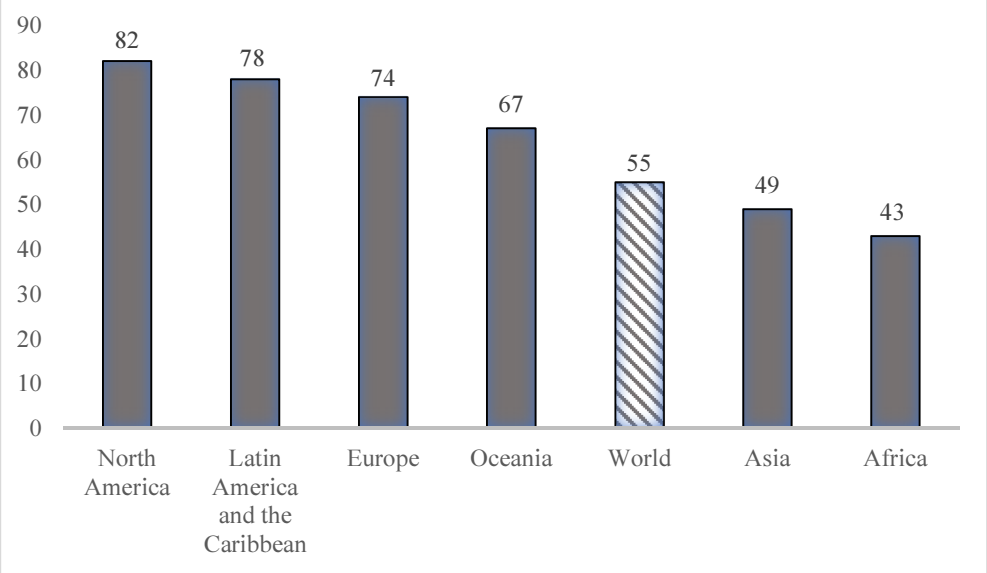


Source: ESCAP calculations based on data from the United Nations, *World Urbanization Prospects: The 2018 Revision* (New York, 2018).

17. The rate of urbanization in developing countries implies an increasing concentration of wealth and consumers in cities, which is driving up the rate of motorization and the demand for urban passenger and freight transport. Here again, it is expected that income levels will grow highest in Asian countries. Some forecasts predict that most changes in transport demand and mobility patterns are expected in Chinese and Indian cities, where the average GDP per capita will double between 2015 and 2030 and is projected to reach more than three times its 2015 level in 2050.[8] At the same time, the composition of emerging urban centres and megacities in the region includes a significant proportion of households in poverty that spend a higher proportion of their income on transport and have lower vehicle ownership rates. This increases the need for effective urban and public transport design.

[8] OECD/International Transport Forum, *ITF Transport Outlook 2017* (Paris, 2017).

Figure III
Urban population as a percentage of total population, by continent in 2018



Source: Population Reference Bureau, "2018 world population data sheet with a special focus on changing age structures" (Washington, D.C., 2018).

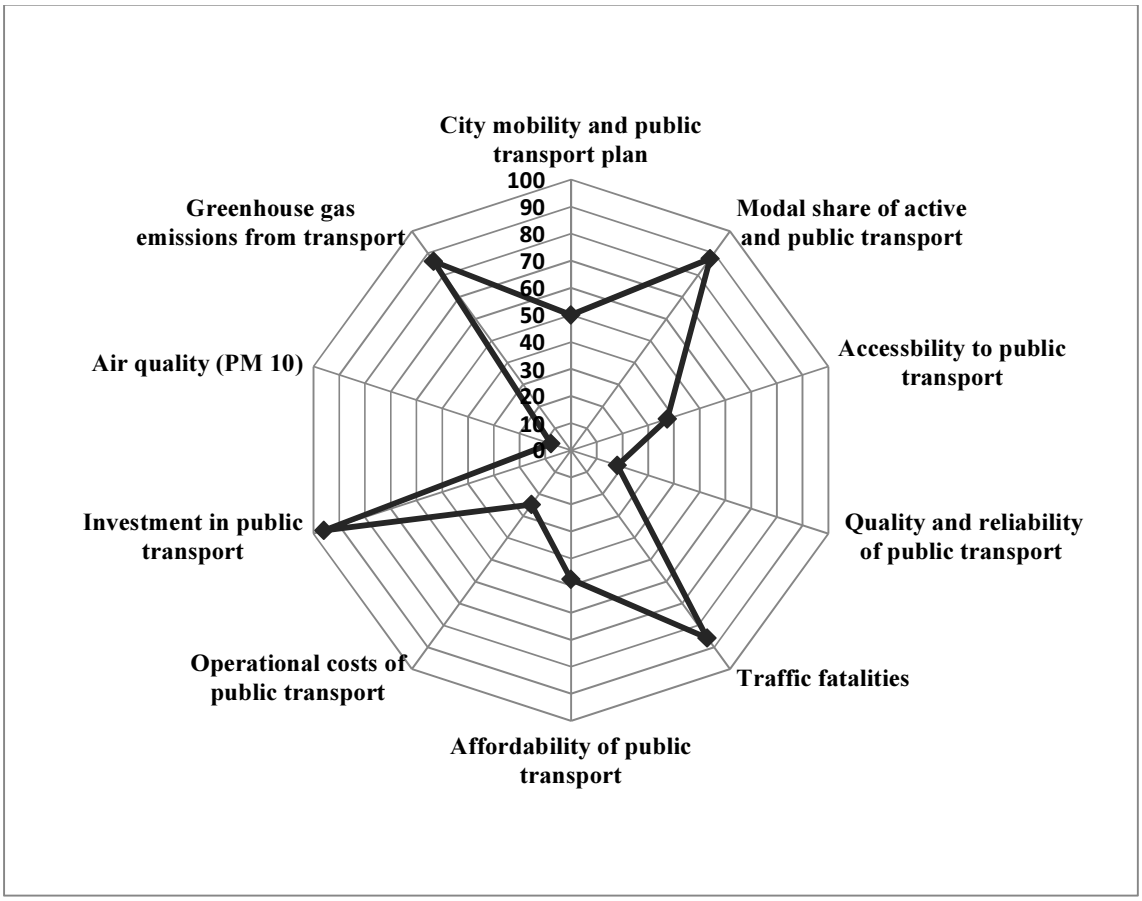
18. It is therefore fitting that Sustainable Development Goal 11 calls for sustainable urban transport. The New Urban Agenda, adopted at the United Nations Conference on Housing and Sustainable Urban Development (Habitat III),[9] also emphasized the urgent need to tackle urban transport challenges. The Ministerial Declaration on Sustainable Transport Connectivity in Asia and the Pacific [10] was endorsed by the Commission in its resolution 73/4. The Declaration acknowledged that following the continuous increase in transport motorization, the major urban transport challenges faced by cities in the region included extending coverage, managing congestion, reducing emissions and air pollution, enhancing safety and ensuring affordability.

19. Against this background, ESCAP developed the sustainable urban transport index, an Excel-based tool that can help summarize, track and compare the performance of urban transport systems in cities. The sustainable urban transport index is a framework of indicators to assess the sustainability of urban transport systems and services. The index is based on 10 indicators representing, transport system, social, economic and environmental dimensions of sustainable urban transport. The 10 indicators cover elements of planning, access, safety, quality and reliability, affordability and emissions. Indicators on different scales are normalized and the performance of each indicator is compared on a scale of 1 to 100 and illustrated in a spider diagram (see figure IV). The sustainable urban transport index can help cities to assess the achievement of Goal 11 target 2 and support the implementation of the New Urban Agenda. Following successful pilot applications, the sustainable urban transport index was endorsed by the fifth session of the Committee on Transport in November 2018.

[9] See General Assembly resolution 71/256, annex.

[10] E/ESCAP/73/15/Add.1.

Figure IV
Sustainable urban transport index: sample spider diagram



Note: PM 10 indicates coarse particulate matter.

C. Transport and the climate change agenda

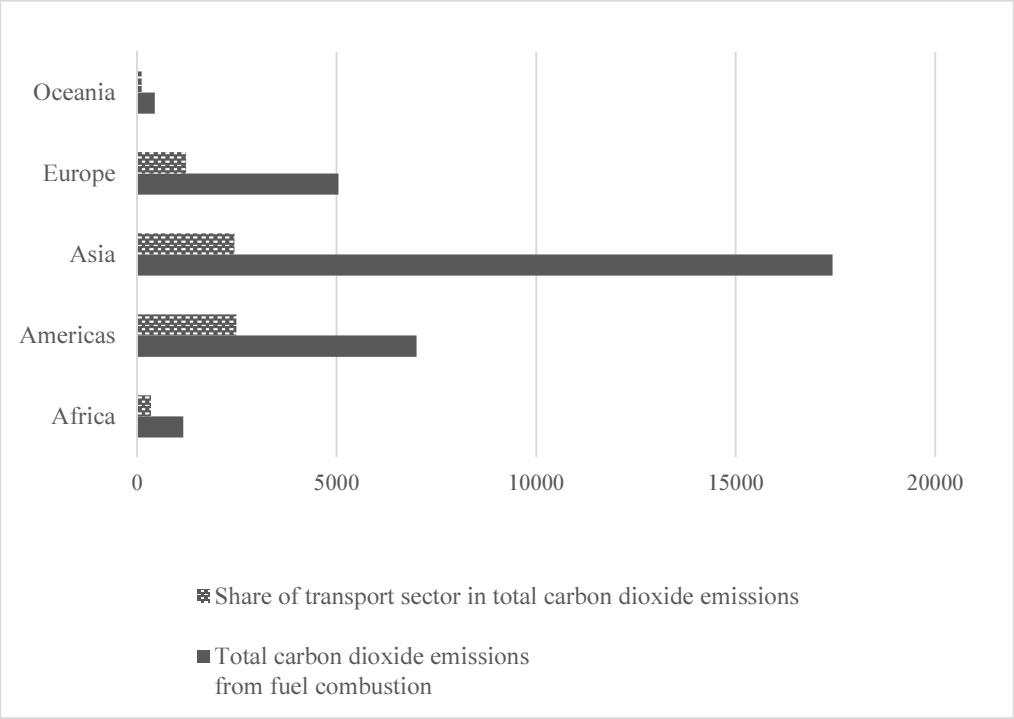
20. The ever-increasing demand for freight and passenger transport is gradually put in the context of the environmental sustainability of the transport sector. The Intergovernmental Panel on Climate Change stated in its Fifth Assessment Report[11] that reducing global transport greenhouse gas emissions will be challenging since the continuing growth in passenger and freight activity could outweigh all mitigation measures unless transport emissions can be significantly decoupled from GDP growth.

21. Yet, the expected growth scenarios for freight and passenger transport indicate that this is far from being accomplished, thus bringing about increasing pressure on the sector to assess and improve its environmental performance. In 2016, the transport sector was responsible for approximately 25 per cent of global emissions at around 8 gigatons of carbon dioxide, which represented a 71 per cent increase over 1990 levels; the road transport sector, which depends primarily on fossil fuels, accounted for 74 per cent of these emissions.[12] Figure V shows carbon dioxide emissions by continent.

[11] Intergovernmental Panel on Climate Change, *Climate Change 2014: Synthesis Report* (Geneva, 2015).

[12] OECD/International Energy Agency, *CO_2 Emissions from Fuel Combustion 2018* (Paris, 2018).

Figure V
Carbon dioxide emissions from fuel combustion by continent in 2016 (Millions of tons)



Source: ESCAP calculations based on data from OECD/International Energy Agency, *CO_2 Emissions from Fuel Combustion 2018* (Paris, 2018).

22. Some estimates suggest that, globally, maritime transport generates about half of the total emissions from international trade-related freight transport, while road transport is responsible for about 40 per cent. Air and rail transport account for 6 per cent and 2 per cent, respectively.[13] Road traffic, in particular, has been growing rapidly as the economic epicentre shifts to emerging markets in Asia and Africa, where rail infrastructure is generally lacking.

23. According to the International Transport Forum's baseline scenario, which is based on current carbon emission rates and policies in effect today, emissions from global transport will rise by 60 per cent between 2015 and 2050. Even in a scenario in which low-carbon technologies will have been deployed, overall emissions in 2050 will only, at best, stay at 2015 levels.[14] Considering that transport volumes are projected to double or triple over the same period, this could be considered a success; still, it would not be sufficient for attaining the global targets on average global temperatures.

24. Of the 60 per cent of transport emissions relating to passenger traffic, nearly half are generated by urban travel.[15] Many cities around the world are facing air pollution peaks, and the number of early deaths from particulate matter less than 2.5 microns in diameter is estimated to increase by over 50 per cent by 2030 from 2015 levels. Introducing low and ultra-low sulphur fuels along with equivalent vehicle emission standards is likely to reduce

[13] OECD/International Transport Forum, ITF Transport Outlook 2017.

[14] Ibid.

[15] Ibid.

cumulative black carbon emissions by 7.1 million tons by 2050, and annual emissions of particulate matter less than 2.5 microns in diameter by over 85 per cent, resulting in an estimated 470,000 fewer premature deaths per annum in 2050, and net climate benefits equivalent to preventing 14 trillion miles of travel by passenger vehicles.[16]

25. The rapid economic growth in the Asia-Pacific region has spurred increased demand for passenger vehicles and caused motorization rates to rise. This trend is set to continue as dependence on two and four-wheeled passenger vehicles in developing countries in Asia will increase in the absence of well-performing public transport systems. While advances in vehicle technologies in the past decade have seen the deployment of more efficient vehicles that emit lower levels of greenhouse gases, the rise in transport demand has outpaced these gains, resulting in increased emissions from the transport sector.

26. Some technological advances, such as electric vehicles, could play a role in reducing city pollution and overall road transport-related emissions, as one of their main benefits is the lack of emissions. At the same time, their use increases demand for electricity generation. Generating electricity and producing liquid fuels for vehicles are different categories of the energy economy, each having its own inefficiencies and environmental harms; both emit carbon dioxide into the environment that can only be accounted for by comparing the full fuel cycle of emissions from production and distribution and from vehicles. For example, an electric vehicle that is recharged with power generated from fossil fuels is not more efficient than a gasoline-powered vehicle, with notable differences observed in countries where electricity supply is dominated by hydropower and nuclear power rather than coal. As such, policies to incentivize the use of electric vehicles should be coupled with simultaneous decarbonization of electricity generation.

27. As stated in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, the understanding of how low-carbon transport and energy technologies will evolve is not well developed, and assessing this gap remains challenging for the transport sector. ESCAP is currently scaling up its support for the policy interventions needed in the region to move towards a climate-neutral transport sector. Such considerations include an evaluation of the modal split and the identification of conditions that would be conducive to a shift to more environmentally friendly modes of transport, such as railways and inland water transport, as well as walking or cycling in the case of passenger transport.

28. In doing so, ESCAP is also paying increased attention to mitigating the environmental impact of transport infrastructure. Infrastructure itself typically accounts for only a small percentage of total greenhouse gas emissions. The contribution from infrastructure to environmental sustainability would, therefore, be to minimize the emissions arising from construction and maintenance. In addition, operating transport more seamlessly across modes, as called for by the Regional Action Programme for Sustainable Transport Connectivity, will mean growing demand for mobility can be accommodated on proportionately less infrastructure, with materially better service to users and significant energy savings.

[16] International Council on Clean Transportation and United Nations Environment Programme, “Cleaning up the global on-road diesel fleet: a global strategy to introduce low-sulphur fuels and cleaner diesel vehicles” (Paris, 2016).

29. While the contribution of the transport sector to global greenhouse gas emissions is well understood, less is known about potential impacts of climatic changes on transport infrastructure, including ports, as well as on inland transport services and networks. Rising sea levels, increased frequency and intensity of extreme storm surges and waves, droughts and/or river floods and increased temperatures, as well as extreme temperature variability and the melting of permafrost pose serious threats to both coastal and inland transport infrastructure and services.

30. Direct impacts include accelerated coastal erosion, port and coastal road inundation/submersion, water supply problems, access restrictions to docks and marinas, deterioration of the structural integrity of road pavements, bridges and railway tracks.[17] This would have implications not only for the viability of freight transport but, importantly, for populations whose mobility would be compromised, thus limiting their access to jobs, health care and other basic services. Indirect impacts are harder to assess and could arise through changes in population concentration and/or distribution, as well as through changes in production, trade and consumption patterns, which are likely to lead to considerable changes in the demand for transport.[18]

31. This implies the need for adaptation measures, which aim to reduce vulnerabilities and increase the resilience of transport systems to climatic impacts. This encompasses the physical robustness of infrastructure and the ability of transport systems to maintain functionality and recover quickly at minimal cost. From the economic perspective, adaptation measures may limit future operational/rehabilitation costs incurred by incremental climatic changes and/or extreme weather events.

32. In this light, further work would be needed to properly assess and identify the climatic vulnerabilities of the Asian Highway and the Trans-Asian Railway, maritime and dry ports, inland waterways and other transport infrastructure assets in the region. For example, ports in the Asia-Pacific region which now account for a significant share of global seaborne trade will require investments to adapt them to climate change induced events. A recent study covering 53 ports in the Asia-Pacific region estimated that the cost for adapting these ports to future climate realities could range from $31 billion to $49 billion.[19]

33. However, the effects of climate change on transport will be felt differently across the globe as some regions will be more severely affected than others. The opening of new sea routes resulting from the melting of Arctic ice will bring benefits in the form of shorter sea routes linking Asia to Europe. In this regard, trial runs of cargo vessels between Asia and Europe have already taken place and Arctic sea routes could become feasible in the near future.[20] It should be noted, however, that the impact of melting Arctic ice will adversely affect low-lying coastal States and small island developing States. Therefore, new commercial opportunities may not outweigh the consequences of population displacement expected to result from this development.

[17] G. Gelete and H. Gokcekus, "The economic impact of climate change on transportation assets", *Journal of Environmental Pollution and Control*, vol. 1, Issue 1 (September 2018).

[18] Rob Dellink and others, "International trade consequences of climate change", OECD Trade and Environment Working Papers, 2017/01 (Paris, OECD, 2017).

[19] Ben McCarron and others, "Climate Costs for Asia-Pacific Ports" (Asia Research and Engagement, 2018).

[20] Reuters, "Maersk sends first container ship through Arctic route", 24 August 2018.

34. In conclusion, while the linkage between transport and climate change has been established at the global and regional level, much more needs to be done to make this link operational in terms of regional and national transport policies. Climate-adapted transport projects are already being promoted by multilateral development banks and other development actors, often with loans being contingent upon adaptation planning. However, these considerations need to be integral to the national and regional transport planning processes currently underway in the region.

D. Technology and innovation

35. Faced with the rising requirements for capacity and the overall performance of transport systems, it is often considered that the advent of new transport solutions or radically different technologies could profoundly transform transport. Indeed, the transport sector today is being revolutionized by advances in technology, and the transformation of modern transport networks could change the way people and goods are moved from origins to destinations.

36. Factors that have influenced the transport sector include the emergence of intelligent transport systems, which have evolved from the intersection of information and communications technologies and transport services. Intelligent transport systems aim to make transport more efficient, safe and environmentally friendly. Applications such as advanced traffic management systems, which provide real-time traffic information and monitoring of traffic flows and advanced public transport systems and traveller information systems, are already relatively widespread, although their full benefits have yet to be reaped. ESCAP is implementing projects in support of the deployment of intelligent transport systems in the region. The most recent project on innovative and integrated intelligent transport systems for the development and operation of sustainable transport systems in urban areas provides a comprehensive analysis of the status of intelligent transport systems and policy recommendations aiming to foster their development in Asia and the Pacific.

37. Major ongoing developments and related policy debates involve connected vehicles, autonomous vehicles and unmanned aerial vehicles, among others.

38. Connected vehicles use wireless or telecommunications technology to link to transport infrastructure and other components of the transport network, such as other vehicles, motorcycles and pedestrians. Such technologies can enable real-time communications between components of the transport network and could thus improve traffic safety and emergency response services; and analysing real-time traffic flow data across highways or urban centres can lead to smooth traffic flow.

39. Autonomous vehicles can be defined as vehicles that incorporate varying degrees of automation and consequently require different levels of human involvement for operation. In principle, fully autonomous vehicles would require no human intervention and their operation would be fully automated through a combination of on-board sensors, computer programs, maps, satellite positioning systems and related technologies. Autonomous vehicles have the potential to transform transport by improving safety, reducing road crashes and improving overall efficiency. While they are still undergoing extensive tests and pilot runs, they could become commercially viable in the near future.

40. The implications of introducing autonomous vehicles should not be overlooked. Major discussions currently focus on the short- and medium-term safety risks related to the parallel circulation of autonomous vehicles and traditional vehicles, as human error will continue to play a role until the global fleet has been completely replaced. The discussions include the conditions under which these vehicles can share the road with traditional vehicles; insurance and liability considerations; the issues that may arise with regard to driver training and licencing; and corresponding traffic code revisions and special legislative and regulatory measures that may need to be introduced.

41. Another element that can find critical applications for transport is the use of unmanned aerial vehicles (drones). The first applications of drones in infrastructure maintenance were for high-voltage electricity pylons, wind turbines, telecommunication masts and bridges – structures where frequent and precise monitoring is crucial to ensure safety and correct operation. Drones equipped with high-resolution cameras and scanners can collect precise data for infrastructure inspections, and advances in image processing can offer precision that is unattainable by the human eye. This is most important when access to infrastructure is difficult or dangerous. Drones can be equipped with other sensors to provide road and railroad operators with easy access to detailed data that today are very costly, if not impossible, to collect.[21] Another area where drones could potentially play a role is in connecting rural areas or zones that may not have access to all-weather roads. In times of natural calamities, drones could play a role in rescue operations by dropping emergency supplies. In an urban setting there is already talk of deploying drones for the delivery of packages to customers and tests of single passenger drones for short distance travel are currently underway.

42. Drone-powered innovation is significant development from several points of view, and their use is becoming increasingly commonplace in several countries. However, despite their use coming at a cost significantly lower than that of conventional methods, challenges remain to be addressed, such as aviation risks, flight management, training and expertise, privacy and cybersecurity concerns, to name a few, all of which warrant further consideration and research. ESCAP is in the early stages of research on the applications of drones in transport in collaboration with research institutions and industry to better understand the regulatory and technical implications of this technology.

43. While information and communications technology will play a key role in the future development of the transport sector, transport policymakers and regulators will need to pay attention to new security risks and to the limitations of the technology's impact on the overall sustainability performance. As far as security risks are concerned, connected vehicles are vulnerable to hacking and theft. The deployment of wireless technologies for connected vehicles will require the harmonization of standards across service providers, vehicle manufacturers and other stakeholders. Autonomous vehicles could also be affected as a result of a backlash from transport unions and truck drivers who may be negatively affected by these technologies.

44. Technological innovation may not bring the expected sustainability gains. For instance, although various transport modelling studies use different methodologies, they seem to converge in suggesting that a future transport system that relies heavily on autonomous vehicles will most likely see

[21] See PwC, "Clarity from above: transport infrastructure – the commercial applications of drone technology in the road and rail sectors" (January 2017).

increased overall vehicle kilometres travelled, even if the vehicles are shared.[22]

45. As highlighted by the recent research on the governance of "smart mobility", the overall performance of the transport sector is persistently suboptimal on measures of sustainability, despite constant technological progress, which shows that there is no guarantee that smart mobility will be conducive to sustainable development. Many different potential smart mobility systems can be implemented for any given package of technological innovations. Moreover, the driving role of the technology sector in marketing sensors, vehicles and software for smart mobility products maintains strongly vested interests in favour of more mobility, not less, in order to maximize returns on investments.[23]

46. In conclusion, traditional transport policy and planning approaches tend to give more consideration to economic aspects that are linked strongly to economic growth and the need to support global and regional trade. Some demographic as well as environmental concerns, such as urbanization processes or climate change, are making their way into national, regional and global policies, although much remains to be done.

47. While part of the social development agenda is captured by considering the impact of demographic trends on transport and mobility needs, and while the issues related to social development are usually incorporated in the overall strategic objectives for national policies, these issues still warrant greater political visibility and financial support to redress existing inequalities in the availability and quality of transport services. The following section offers further reflections on the social dimensions of transport development.

III. Social dimensions of transport development

48. As mentioned before, transport has been recognized as a major enabler of economic and social development. This premise is often limited to broader socioeconomic benefits of cross-border transport connectivity as an enabler of trade and economic activity, as well as to providing access to jobs, health care, education, among others. That is to say, the social benefits of transport policies have often been believed to evolve as a by-product of the economic stimulus of infrastructure development and corresponding increase in the volume of goods and passengers transported.

49. While these assertions hold true to a large extent, they do not necessarily reveal the full extent of the social dimensions of transport, which must be understood at a deeper level and considered more systematically in the policymaking process in the pursuit of the Sustainable Development Goals. Sustainable transport, by definition, ought to consider all dimensions of sustainable development equally. The economic and environmental considerations are largely covered, even if environmental performance is not comprehensively covered. The social dimensions of transport other than road safety, which is extensively addressed in numerous forums, including those of ESCAP, need to be addressed more thoroughly and systematically. To illustrate this need, four major social development elements of transport can be further highlighted: accessibility; transport and gender; disruptive trends on the

[22] Tom Van Vuren, "Uncertain futures but consistent modelling messages", 7 September 2018. Available at https://www.linkedin.com/pulse/uncertain-futures-consistent-modelling-messages-tom-van-vuren/.

[23] Iain Docherty, Greg Marsden and Jillian Anable, "The governance of smart mobility", *Transportation Research Part A: Policy and Practice*, vol. 115 (September 2018).

transport labour market; and social development perspectives of cross-border connectivity. Incorporating these social elements in transport planning can effectively increase empowerment and equality levels in the region.

A. Transport and accessibility

50. Transport is typically understood as an intermediary or a means to an end. The range of destinations accessible at any given departure point will inevitably impact the range of choices made by individuals, social groups, businesses and so on. It follows that poverty and immobility are correlated; however, access to transport infrastructure should not be assumed to be an accurate or absolute indicator of access to destinations or opportunities for employment, health care or education, among others. For example, access to a road does not mean that there is access to transport services nor that schools, hospitals or other services at the destination are accessible at a reasonable time and cost. One needs to factor in whether and how well connected the road is to a broader network, whether public transport services are provided on the road or if car ownership is the only option, and whether car ownership or public transport is affordable, including for the economically disadvantaged, older persons and persons with disabilities. Therefore, equating access to transport with access to opportunity largely depends on whether the transport system ensures that these basic needs are met; and whether transport policy, investment and design are part of a broader social and/or poverty reduction strategy.

51. For instance, women constitute half the world's working population but generate only 37 per cent of GDP.[24] It is broadly discussed in the literature that this can be attributed in large measure to immobility or "transport poverty".[25] As road construction in remote areas is costly and the number of beneficiaries per kilometre of road is relatively low, investment in rural roads is lagging behind. It has also been documented that poorer residential areas in today's megacities often lack access to road infrastructure and connectivity with the rest of the city. This is estimated to negatively affect 700 million people in Asia.

52. A number of academic studies have examined the mobility challenges facing older persons in rural areas in Asia, where declining populations, a shortage of public transport services and fewer opportunities to be driven by family members or friends are combining to increase exclusion risks[26] and illustrate that cultural and social norms affect the ways in which older persons manage their mobility. In this regard, it would be worth discussing whether the tendency of older persons to accept reduced mobility as a natural consequence of ageing should determine policy responses, or whether policymakers ought to actively provide adequate mobility opportunities for all and ensure inclusion. Other factors influencing mobility trends and priorities are the increasing number of single-parent households and older drivers, and the increasing rate of motorization and corresponding number of traffic accidents. ESCAP

[24] Marie Thynell, "Roads to equal access: the role of transport in transforming mobility", *Transport and Communications Bulletin for Asia and the Pacific, No. 87 - Transport and Sustainable Development Goals* (ST/ESCAP/SER.E/87).

[25] Karen Lucas and others, "Transport poverty and its adverse social consequences", *Proceedings of the Institution of Civil Engineers - Transport*, vol. 169, Issue 6 (December 2016).

[26] Janet Stanley and John Stanley, "The importance of transport for social inclusion", *Social Inclusion*, vol.5, No. 4 (December 2017).

dedicates significant resources to addressing road safety in all its dimensions[27] and has adopted regional road safety goals and targets for 2016–2020.[28]

53. In the issues of access and beyond, the transport sector at large is being called upon to better articulate its role in poverty reduction. Improved transport alone cannot reduce poverty. Transport systems are development prerequisites, but in the absence of a special focus on poverty reduction and accompanying wider policies they cannot bring about well-being or solve the challenges of poverty, gender imbalances and increasing inequality associated with social mobility[29] or fully play their role as a key mechanism for the development of human capabilities.[30]

B. Transport and gender

54. Transport infrastructure and services are often considered "gender neutral", however transport projects do not, in fact, equally benefit men and women. Most research on transport and gender has focused on end users and analysed mobility choices and patterns; this is largely on account of data availability which makes this approach more comprehensive as compared to other perspectives on gender. It is well documented that women, particularly in low- and middle-income countries, have particular mobility patterns owing to their socially determined reproductive, productive and community-related gender roles. Women's mobility is characterized by "trip-chaining", which involves multiple short or combined trips, typically by public transport, to fulfil several different objectives in as little time as possible. Women may turn down employment opportunities further distances away from home if the transport system does not enable them to travel to and from work in time to also meet their domestic and family care obligations or provide ample space and flexibility for women to travel with dependents and household goods. Instead, they may have little choice but to accept lower-paid local job opportunities or informal income sources closer to home.[31]

55. Women's mobility choices are also often dictated by safety concerns, such as theft, assault or sexual harassment, all of which, statistically, affect women more than men. Gender transport patterns can also be influenced and determined by sociocultural practices, such as in societies where women are generally required to be escorted by a family member.[32] At the same time, there is an increasing diversity in women's travel patterns, making the accurate and regular assessments of their travel an indispensable step in devising gender-sensitive transport policies.

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[27] Extensive information on ESCAP activities on road safety can be found in ESCAP/CTR/2018/7.

[28] E/ESCAP/MCT(3)/11, Annex VI.

[29] Paul Starkey and John Hine, "Poverty and sustainable transport: How transport affects poor people with policy implications for poverty reduction: A literature review", (Nairobi, United Nations Human Settlements Programme; London, Overseas Development Institute; Shanghai, China, Partnership on Sustainable Low Carbon Transport, 2014).

[30] Eda Beyazit, "Evaluating social justice in transport: lessons to be learned from the capability approach", *Transport Reviews*, vol. 31, 2011, Issue 1, pp. 117–134.

[31] Asian Development Bank, *Gender Toolkit: Transport - Maximizing the Benefits of Improved Mobility for All* (Manila, 2013).

[32] Ibid.

56. Designing transport to respond to gender needs would require including women more systematically in the transport sector and in decision-making processes. While extensive data are generally lacking on this issue in Asia and the Pacific, the rate of participation of women in transport-related meetings of the United Nations could serve as an indicator that suggests that women are underrepresented in transport. As such, it is imperative that research on gender and transport move beyond the end-user perspective and delve deeper into transport as an employer of women, including in decision-making positions, which would serve the objective of better designed and, eventually, gender-sensitive transport systems. To that end, improved statistics and gender disaggregated data are essential to ensure systematic gender inclusion procedures for transport, in the training of professionals, as well as in the design and planning of networks and services.

C. Disruptive trends on the transport labour market

57. The transport sector has traditionally been a labour-intensive and employment-generating sector. However, the outlook for transport development may imply a trend of reduced employment opportunities or increasing demand for skilled employees as a result of technology applications and automation. This may create new opportunities for highly specialized workers to support the planning and implementation of the intelligent transport system in the region. However, the social impact of the reduced demand for low-skilled transport workers may expectedly generate pressure on unemployment rates and poverty levels.

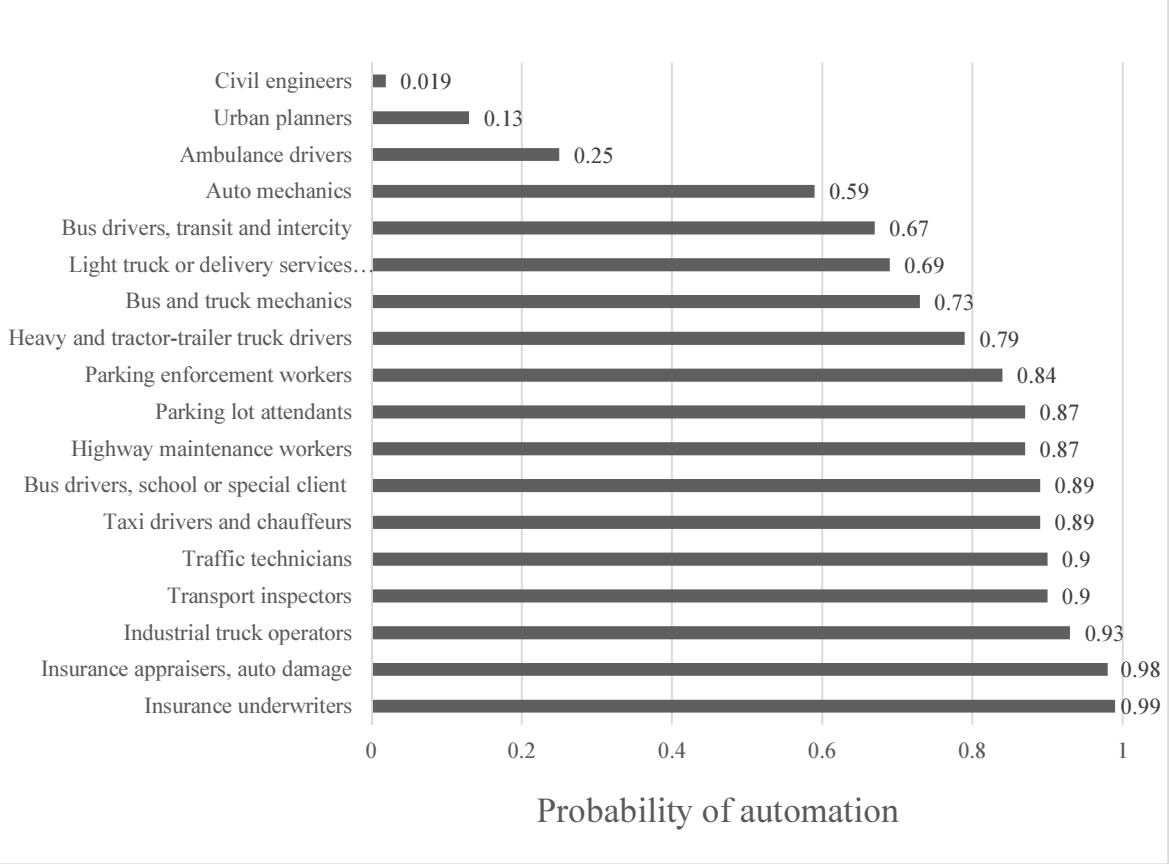
58. A widely noted study published in 2013 examined the probability of computerization for 702 occupations and found that most occupations in transport and logistics could be automated to some extent in the future, including taxi, freight and public transport drivers (see figure VI). Technological transformations in other sectors have shown that new roles tend to require higher skills and education, particularly in science, technology, engineering and mathematics, and positions are generally higher paid.[33] The requirement of higher skills can create difficulties for retraining displaced employees for new roles.

59. The World Maritime University noted in a recent report that the introduction of highly automated ships will lead to a decrease in the global demand for seafarers by 2040 vis-à-vis the baseline projection based on current technology. Furthermore, estimates for countries participating in the survey of the Programme for the International Assessment of Adult Competencies of the Organization for Economic Cooperation and Development (OECD) showed that 5.7–50 per cent of low-skilled workers, such as dockers and baggage handlers, are exposed to high risks of automation, as their jobs will not exist in their current form by 2040, since more than 70 per cent of their tasks are automatable.[34]

[33] Stefan Hajkowicz and others, *Tomorrow's Digitally Enabled Workforce: Megatrends and Scenarios for Jobs and Employment in Australia Over the Next Twenty Years* (Brisbane, Australia, Commonwealth Scientific and Industrial Research Organisation, 2016). Available at www.acs.org.au/content/dam/acs/acs-documents/16-0026_DATA61_REPORT_TomorrowsDigiallyEnabledWorkforce_WEB_160128.pdf.

[34] World Maritime University, *Transport 2040: Automation, Technology, Employment - The Future of Work* (2019). Available at www.wmu.se/docs/transport-2040-future-work.

Figure VI
Automation potential of select mobility-related occupations



Source: Carl Benedikt Frey and Michael Osborne, "The future of employment: How susceptible are jobs to computerization?", Working Paper (Oxford, University of Oxford, 2013).

60. Against this background, emerging national and regional transport policies will only fully realize their role in enhancing social development if they eventually incorporate lifelong learning and adult education systems, as well as social safety nets that would allow for repeated and viable professional transitions within and beyond the sector.[35]

D. Social development perspectives of cross-border connectivity

61. Turning to the perspective of cross-border transport connectivity, a recent report highlights that while savings of travel time and vehicle operating costs remain central elements of cost-benefit analyses for transport projects, these savings are unable to capture the full economic benefits of a transport project. Conversely, interest is rising in the wider economic benefits of large transport projects, which include impacts on development outcomes such as:[36]

[35] See McKinsey Global Institute, "A future that works: automation, employment and productivity" (New York, McKinsey and Company, 2017); and Mårten Blix, "Structural change and the freight transport labour market", Discussion Paper No. 2017–12 (OECD/International Transport Forum, 2017).

[36] World Bank and others, *The WEB of Transport Corridors in South Asia* (Washington, D.C., 2018).

(a) Economic welfare (income, wages, consumption);

(b) Social inclusion (jobs, gender);

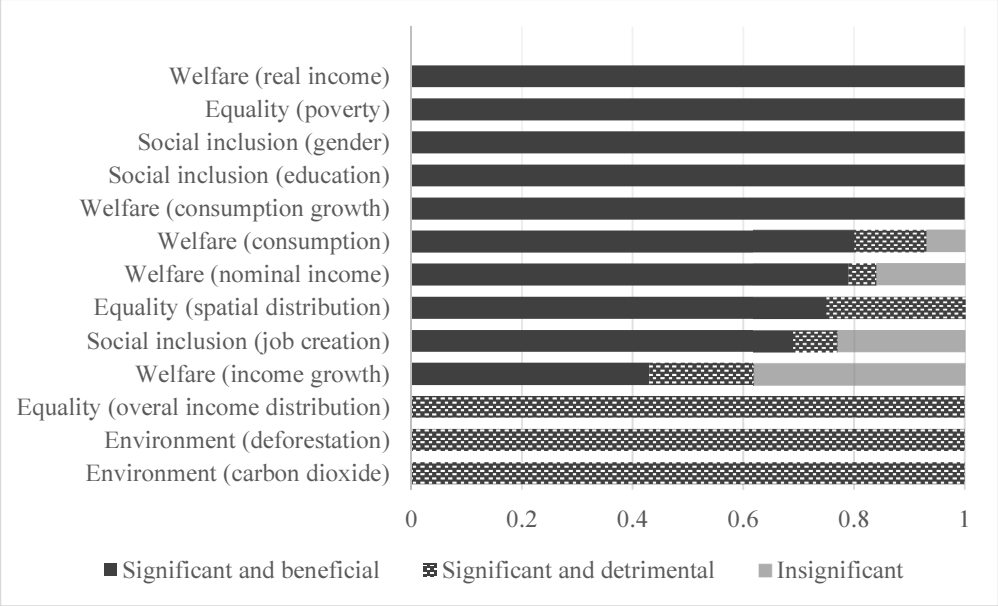
(c) Equity (poverty, inequality);

(d) Environmental quality (pollution, deforestation);

(e) Economic resilience (unexpected losses due to large shocks or protracted trends).

62. Deciding on how to enhance transport connectivity often involved trade-offs between different types of variables and this is especially so when social impacts are concerned (see figure VII). For instance, boosting income can come at the expense of rising inequality. In planning international transport corridors, there may also be divergent interests in terms of international and domestic connectivity, as, for example, the shortest route may be more cost-efficient and, thus, more competitive, but a longer transport corridor may offer benefits in terms of domestic connectivity and territorial integration at the country level. Along those lines, scholars and institutions are increasingly incorporating social considerations in their assessment of corridor projects and stressing the varied impacts of transport investments across multiple economic and other actors.[37]

Figure VII
Wider economic benefits of transport corridor investments



Source: Mark Roberts and others, "Transport corridors and their wider economic benefits: a critical review of the literature", Policy Research Working Paper, No. 8302 (Washington, D.C., World Bank, 2018).

[37] Julie Rozenberg and Marianne Fay, *Beyond the Gap: How Countries Can Afford the Infrastructure They Need While Protecting the Planet – Sustainable Infrastructure Series* (Washington, D.C., World Bank, 2019).

63. As the region gains experience in applying the wider economic benefits approach to transport corridors, it has become increasingly apparent that capturing tangible benefits to social development is contingent on incorporating these considerations from the initial stages of corridor planning and on actively involving all stakeholders. Transport corridors can spur equitable growth only when incorporating the economic, social and environmental effects of spatial developments; in turn, fair distribution of the expected benefits is critical for the political sustainability of corridor investments.

64. There is, thus, a pressing need to better incorporate sustainable connectivity dimensions, including social aspects, in the appraisal methodologies and tools of regional projects. Current infrastructure plans in Asia focus on key international corridors, but they do not always meet the need to ensure the connectivity of local businesses to these corridors, which is crucial for realizing benefits from agglomeration economies and for positive social impacts. Moreover, in many cases, project selection methodologies do not include systematic assessments incorporating comprehensive cost-benefit analysis, multiple-criteria analysis as well as the risk and uncertainty analysis. Finally, there is limited use of quantitative models and a notable shortage of data availability and reliability, especially when it comes to measuring the social impacts of enhanced transport connectivity.

65. In short, Asia and the Pacific has yet to fully define the optimal package of corridor interventions that extends beyond the investment in transport infrastructure to include reforms and policies that amplify the wider economic benefits of that infrastructure, to include areas of unrealized economic potential or possible positive spillovers for social development. Such an approach should be applied in further developing the regional transport infrastructure network, building on the legal and institutional foundation provided by the Intergovernmental Agreements on the Asian Highway Network, the Intergovernmental Agreement on the Trans-Asian Railway Network and the Intergovernmental Agreement on Dry Ports.

IV. Strategic considerations and way forward

66. The above considerations lead to a number of strategic conclusions for the future work of ESCAP on transport connectivity. In the first instance, social aspects of transport connectivity need to gain further prominence in current transport policies at the national and regional levels. The link between transport connectivity and social development issues is easy to ascertain, but upon closer inspection it is not always being sufficiently addressed by transport policies and regional cooperation processes on transport connectivity. Redressing this implies significant, persistent and regionally coordinated efforts to incorporate social development considerations into the initial phases of policy definition and decision-making processes. In so doing, traditional and emerging drivers of policy formulation, as discussed in the present document, will have a higher synergetic impact on sustainable development efforts in the region.

67. Furthermore, putting greater emphasis on the social dimensions of transport policy should not come at the expense of economic and environmental dimensions. Conversely, it is imperative to recognize that empowerment and equality cannot be attained in the absence of functional, well-connected and resilient transport systems, which facilitate economic development and mobility.

68. Finally and in line with the considerations above, a focus on increasing the quality of transport services could help reconcile often-competing sustainability interests. In this context, links between economic, social and environmental aspects of transport development should be further explored to identify the ways in which transport services can meet the demand of economic growth, reduce environmental impact and ensure the resilience of people and communities to shocks and disruptions, whether climate-related or not.

69. In this context, the Commission may wish to:

(a) Consider calling on the secretariat to scale up its activities in support of greater integration of the social aspects of regional transport connectivity within the scope of its current mandate by inter alia:

(i) Helping countries apply an integrated and sustainable approach to regional transport connectivity, balancing the social, environmental and economic concerns and identifying specific policy recommendations for regional infrastructure planning, especially along the Asian Highway network, the Trans-Asian Railway network and the network of dry ports of international importance;

(ii) Assisting countries in intensifying their efforts to fully incorporate meaningful and evidence-based social and gender considerations, in particular, in their domestic transport policies and activities, especially on rural and urban mobility;

(iii) Expanding its work on technology and intelligent transport systems to help countries assess the implications of new technology applications on transport policy goals, including social development goals.

(b) Comment and provide additional guidance, as appropriate, on the ideas put forward for raising the profile of the social aspects of transport development, particularly in the consideration of the second phase of the Regional Action Programme for Sustainable Transport Connectivity, to be launched in 2021.